SCHEME OF INSTRUCTION (R-22A)
OF
B.E. I to VIII SEMESTERS of FOUR YEAR DEGREE COURSE
IN
COMPUTER SCIENCE AND ENGINEERING

(Inline with AICTE Model Curriculum with effect from AY **2024-25**)

(R-22A Regulation)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Affiliated to OU, Approved by AICTE, Accredited by NBA, NAAC(A++)
Kokapet Village, Gandipet Mandal, Hyderabad–500075.Telangana
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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

OUR MOTTO: SWAYAM TEJASWIN BHAVA

Institute Vision	To be a Centre of excellence in technical education and research
Institute Mission	To address the emerging needs through quality technical education and advanced research.
Department Vision	To be in the frontiers of Computer Science and Engineering with academic excellence and Research.
Department Mission	M1 To be in the frontiers of Computer Science and Engineering with academic excellence and Research. M2 Develop professionals with sound knowledge in theory and practice of Computer Science and Engineering M3 Facilitate the development of academia-industry collaboration and societal outreach programs M4 Prepare students for full and ethical participation in a diverse society and encourage lifelong learning
PEO 1	Graduates will apply their knowledge and skills to succeed in their careers and/or obtain advanced degrees, provide solutions as entrepreneurs.
PEO 2	Graduates will creatively solve problems, communicate effectively, and successfully function in multi-disciplinary teams with superior work ethics and values.
PEO 3	Graduates will apply principles and practices of Computer Science, mathematics and Science to successfully complete hardware and/or software-related engineering projects to meet customer business objectives and/or productively engage in research.
PSO 1	Able to acquire knowledge and practical competency for providing solutions to the problems related to Computer Science and Engineering.
PSO 2	Able to design and develop innovative solutions for complex problems by applying the concepts of emerging domains including AI, ML, IoT, Data Science, security and cloud .
PSO 3	Able to gain knowledge and skills to develop, deploy and maintain software using modern Software Engineering principles and practices.

Program Outcomes of BE (CSE) Program

PO1:	Engineering Knowledge	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2:	Problem Analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO3:	Design/Development of Solutions	Design creative solutions for complex engineering problems and design / develop systems / components / processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4:	Conduct Investigations of Complex Problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5:	Engineering Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6:	The Engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO7:	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO8:	Individual and Collaborative Team work	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9:	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10:	Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11:	Life-Long Learning	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

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(R22A Regulation)

SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC01	Linear Algebra and Calculus	3	1	-	3	40	60	4
2	22PYC01	Optics and Semiconductor Physics	3	-	-	3	40	60	3
3	22CSC01N	Problem Solving and Programming using C	2	1	-	3	40	60	3
4	22EGC01N	English	2	-	-	3	40	60	2
PRACTICAL									
5	22PYC03	Optics and Semiconductor Physics Lab	-	-	3	3	50	50	1.5
6	22EGC02N	English lab	-	-	2	3	50	50	1
7	22CSC02N	Problem Solving and Programming using C Lab	-	-	3	3	50	50	1.5
8	22MEC01N	Engineering Graphics	-	1	3	3	50	50	2.5
9	22MEC38N	Digital Fabrication Workshop	-	-	3	3	50	50	1.5
TOTAL			**10**	**3**	**14**	**-**	**410**	**490**	**20**
Clock Hours Per Week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

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SEMESTER-II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC04	Differential Equations and Numerical Methods	3	1	-	3	40	60	4
2	22CYC01	Chemistry	3	-	-	3	40	60	3
3	22EEC01	Basic Electrical Engineering	2	1	-	3	40	60	3
4	22ITC20N	Data Structures using C ++	3	-	-	3	40	60	3
PRACTICAL									
5	22CYC02	Chemistry Lab	-	-	3	3	50	50	1.5
6	22MBC02N	Community Engagement	-	-	2	-	50	-	1
7	22ITC21N	Data Structures using C++ Lab	-	-	2	3	50	50	1
8	22MEC37N	Robotics and Drones Lab	-	1	3	-	100	-	2.5
9	22EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
TOTAL			**11**	**3**	**12**	**-**	**460**	**390**	**20**
Clock Hours Per Week: 26									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

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SEMESTER – III

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22ITC02N	Java Programming	3	-	-	3	40	60	3
2.	22CSC06	Discrete Structures	4	-	-	3	40	60	4
3.	22CSC07N	Digital Logic Design	3	-	-	3	40	60	3
4.	22CSC14N	Design and Analysis of Algorithms	3	-	-	3	40	60	3
5.	22ECC36	Basic Electronics and Sensors	3	-	-	3	40	60	3
6.	22EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	50	Non Credit
PRACTICAL									
7.	22ITC03N	Java Programming Lab	-	-	3	3	50	50	1.5
8.	22CSC47	Python Programming Workshop	-	-	3	3	50	50	1.5
9.	22ECC37	Basic Electronics and Sensors Lab	-	-	2	3	50	50	1
10.	22CSI01N	MOOCs / Training / Internship	3 to 4 weeks / 90 Hours			-	50	-	2
		TOTAL	**18**	**-**	**8**	**-**	**400**	**500**	**22**
Clock Hours Per Week: 26									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

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SEMESTER – IV

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22CSC10N	Computer Organization and Architecture	4	-	-	3	40	60	4
2.	22CSC11N	Database Management Systems	3	-	-	3	40	60	3
3.	22CSC48	Theory of Computation	3	-	-	3	40	60	3
4.	22CSC42	Web Programming	3	-	-	3	40	60	3
5.	22MTC12	Probability and Statistics	3	1	-	3	40	60	4
PRACTICAL									
6.	22CSC43	Web Programming Lab	-	-	3	3	50	50	1.5
7.	22CSC13N	Database Management Systems Lab	-	-	3	3	50	50	1.5
8.	22CSC09N	Latex Workshop	-	-	2	3	50	50	1
9.	22CSU01	Up Skill Certification Course-I	-			-	25	-	0.5
		TOTAL	**16**	**1**	**8**	**-**	**375**	**450**	**21.5**
Clock Hours Per Week: 25									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

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SEMESTER - V

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22ITC10N	Computer Networks	3	-	-	3	40	60	3
2.	22CSC15N	Operating Systems	3	-	-	3	40	60	3
3.	22CSC21N	Software Engineering	3	-	-	3	40	60	3
4.	22CSC59	Fundamentals of Data Science	3	-	-	3	40	60	3
5.	22CSExx	Professional Elective Course-I	3	-	-	3	40	60	3
6.	22xxxxx	Open Elective Course-I	3	-	-	3	40	60	3
PRACTICAL									
7.	22ITC11N	Computer Networks Lab	-	-	3	3	50	50	1.5
8.	22CSC18N	Operating Systems Lab	-	-	3	3	50	50	1.5
9.	22CSC49	Software Engineering Lab	-	-	3	3	50	50	1
Total			**18**	**-**	**9**	**-**	**390**	**510**	**22**
Clock Hours Per Week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

Professional Elective – I	
22CSE01	Computer Graphics and Multimedia
22CSE03N	Optimization Techniques
22CSE17	Mobile Application Development
22CSE19	Big Data Analytics
22CAE03N	Image Processing

Open Elective - I	
22BTO01	Biology For Engineers
22CEO02	Disaster Risk Reduction and Management
22CHO04	Environmental and Sustainable Development
22MEO01	Principles of Design Thinking
22ECO05	Principles of Embedded Systems

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SEMESTER – VI

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22CSC24N	Compiler Design	3	-	-	3	40	60	3
2.	22CSC50	Artificial Intelligence and Machine Learning	4	-	-	3	40	60	4
3.	22CSC52	Data Analysis and Visualization	3	-	-	3	40	60	3
4.	22CSExx	Professional Elective Course-II	3	-	-	3	40	60	3
5.	22CSExx	Professional Elective Course-III	3	-	-	3	40	60	3
6.	22MBC01	Engineering Economics and Accountancy	3	-	-	3	40	60	3
PRACTICAL									
7.	22CSC25N	Compiler Design Lab	-	-	2	3	50	50	1
8.	22CSC51	Artificial Intelligence & Machine Learning Lab	-	-	3	3	50	50	1.5
9.	22CSC26N	Mini Project	-	-	3	-	50	-	1.5
10.	22CSU02	Up Skill Certification Course-II/MOOCs/ NPTEL	-	-	-	-	25	-	0.5
TOTAL			**19**	**-**	**8**	**-**	**415**	**460**	**23.5**
Clock Hours Per Week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

Professional Elective-II	
22CSE04	Concurrent Programming
22CSE05	Advanced Database Systems
22CSE06N	Algorithmic Game Theory
22CSE07N	Nature Inspired Algorithms
22CIE53	Blockchain Technology

Professional Elective-III	
22CSE08	User Interface and User Experience Design
22CSE09N	High Performance Computing
22CSE10N	Software Project Management
22CSE21	Extended Reality
22CSE22	Business Analytics

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SEMESTER – VII

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22CSC54	Deep Learning for Computer Vision	3	-	-	3	40	60	3
2.	22CSC56	Network Security	4	-	-	3	40	60	4
3.	22EEM01	Universal Human Values-II: Understanding Harmony	-	1	-	-	50	-	1
4.	22CSExx	Professional Elective Course -IV	3	-	-	3	40	60	3
5.	22CSExx	Professional Elective Course -V	3	-	-	3	40	60	3
6.	22xxxxx	Open Elective Course-II	3	-	-	3	40	60	3
PRACTICAL									
7.	22CSC57	Network Security Lab	-	-	3	3	50	50	1.5
8.	22CSExx	Professional Elective - V Lab	-	-	3	3	50	50	1.5
9.	22CSC38N	Technical Seminar	-	-	2	-	50	-	1
10.	22CSC37N	Project Part-I	-	-	4	-	50	-	2
TOTAL			**16**	**1**	**12**	**-**	**450**	**400**	**23**
Clock Hours Per Week: 29									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

Professional Elective-IV	
22CSE23	Robotic Process Automation
22CSE25	Cloud Computing Essentials
22CAE08N	Reinforcement Learning
22CSE32	Cyber Security
22ADE76N	Generative AI

Open Elective - II	
22EEO01	Energy Management System
22EGO01	Technical Writing Skills
22CAO02	Ethical Intelligence
22MEO06	Principles of Entrepreneurship and Startups
22BTO04	Bioinformatics

Professional Elective-V	
22CSE15N	Software Testing
22CSE26	Applied Natural Language Processing
22CSE28	Full Stack Development
22CSE30	Internet of Things
22ITE11	Devops Tools

Professional Elective -V Lab	
22CSE16N	Software Testing Lab
22CSE27	Applied Natural Language Processing Lab
22CSE29	Full Stack Development Lab
22CSE31	Internet of Things Lab
22ITE12	Devops Tools Lab

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SEMESTER –VIII

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE	Maximum Marks		
			L	T	P/D	in Hours	CIE	SEE	
THEORY									
1.	22CEM01	Environmental Science	2	-	-	2	-	50	Non Credit
2.	22xxxxx	Open Elective Course-III	3	-	-	3	40	60	3
PRACTICAL									
3.	22EGC03	Employability Skills	-	-	2	3	50	50	1
4.	22CSC39N	Project Part-II	-	-	8	-	100	100	4
TOTAL			**5**	**-**	**10**	**-**	**190**	**260**	**8**
Clock Hours Per Week: 15									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
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Open Elective -III	
22CEO01	Infrastructure for Smart Cities
22ADO01	Industry 5.0:Applcations of AI
22CHO02	Fundamentals of Nano Science and Nano Technology
22EEO06	Waste Management
22EGO02	Gender Sensitization

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OPEN ELECTIVES

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22CSO01N	Introduction to Web Technologies	3	-	-	3	40	60	3
2.	22CSO02	Introduction to Database Management Systems	3	-	-	3	40	60	3
3.	22CSO03	Software Testing Methodology	3	-	-	3	40	60	3
4.	22CSO04N	Web Programming With JavaScript	3	-	-	3	40	60	3
5.	22CSO05N	Fundamentals of Java Programming	3	-	-	3	40	60	3
6.	22CSO06	Introduction to Software Engineering	3	-	-	3	40	60	3

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SYLLABUS

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SEMESTER – I

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC01	Linear Algebra and Calculus	3	1	-	3	40	60	4
2	22PYC01	Optics and Semiconductor Physics	3	-	-	3	40	60	3
3	22CSC01N	Problem Solving and Programming using C	2	1	-	3	40	60	3
4	22EGC01N	English	2	-	-	3	40	60	2
PRACTICAL									
5	22PYC03	Optics and Semiconductor Physics Lab	-	-	3	3	50	50	1.5
6	22EGC02N	English lab	-	-	2	3	50	50	1
7	22CSC02N	Problem Solving and Programming using C Lab	-	-	3	3	50	50	1.5
8	22MEC01N	Engineering Graphics	-	1	3	3	50	50	2.5
9	22MEC38N	Digital Fabrication Workshop	-	-	3	3	50	50	1.5
TOTAL			**10**	**3**	**14**	**-**	**410**	**490**	**20**

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22MTC01

LINEAR ALGEBRA AND CALCULUS

Instruction	3 L + 1 T Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

COURSE OBJECTIVES: This course aims to

1. Explain the Partial Derivatives and the extreme values of functions of two variables.
2. Discuss Physical interpretations of scalar and vector functions.
3. Discuss line, surface and volume integrals.
4. Explain the concepts of basis, dimension of vector space and matrix representation of a linear transformation.
5. Explain the solution of system of linear equations by Matrix Methods.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Determine the extreme values of functions of two variables.
2. Apply the vector differential operator to scalar and vector functions
3. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
4. Determine the basis and dimension of a vector space, compute linear transformation.
5. Apply the Matrix Methods to solve the system of linear equations.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	-	-	-	-	-	-	2	1	-	-
CO 2	3	3	3	3	-	-	-	-	-	-	2	1	-	-
CO 3	3	3	3	3	-	-	-	-	-	-	2	1	-	-
CO 4	3	3	3	3	-	-	-	-	-	-	1	2	-	-
CO 5	3	3	3	3	-	-	-	-	-	-	1	2	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Partial Differentiation and Its Applications: Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobians, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

UNIT-II

Vector Differential Calculus and multiple Integrals: Scalar and Vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities), Irrotational fields and Solenoidal fields, Double integral, Change of order of Integration and Triple integrals.

UNIT-III

Vector Integral Calculus: Line integral, Surface integral and Volume integral. Verification of Green's theorem in a plane (without proof), verification of Stroke's theorem (without proof) and Gauss's divergence theorem (without proof).

UNIT-IV

Vector space: Vector space, Subspace, linear combination of vectors, linear span, row and column spaces, linear dependent, independent vectors, basis, dimension, linear transformation, invertible transformation, matrix of linear transformation, kernel and range of LT, rank and nullity of LT-rank

nullity theorem(without proof), change of basis.

UNIT-V

Matrices: Rank of a matrix, Echelon form, consistency of linear System of equations, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. Seymour Lipschutz, "Schaum's Outline of Linear Algebra", 5th Edition, McGraw Hill, 2013.
4. Gilbert Strang, "Introduction to linear algebra", 5th Edition, Wellesley - Cambridge press, 2016.

SUGGESTED READING:

1. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw- Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publications, 5th Edition, 2016.
3. D. Poole, "Linear Algebra: A Modern Introduction, 2nd Edition", Brooks/ Cole, 2005.
4. Kuldeep Singh, "Linear algebra: step by step". OUP Oxford, 2013.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111104125
2. https://archive.nptel.ac.in/courses/111/107/111107112/ (Unit- 1,3,5 and 6)
3. https://nptel.ac.in/courses/111108098 (Unit-1,3 and 9)
4. https://nptel.ac.in/courses/111102152 (Week -1 to Week- 6)

22PYC01

OPTICS AND SEMICONDUCTOR PHYSICS

(CSE, IT, CSE (AI&ML), CSE (IoT & Cyber Security including Block Chain Technology), AI&ML, AI&DS)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Understand the fundamentals of wave nature of light.
2. Acquire knowledge of lasers, holography and fiber optics.
3. Familiarize with quantum mechanics.
4. Learn the fundamental concepts of solids.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics.
3. Find the applications of quantum mechanics.
4. Classify the solids depending upon electrical conductivity.
5. Identify different types of semiconductors.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	3	2	2	1	1	-	-	2	-	-	-
CO 2	3	3	3	3	3	3	3	2	-	3	2	-	-	-
CO 3	3	3	3	3	3	2	2	1	-	-	2	-	-	-
CO 4	2	2	2	1	2	2	2	1	-	2	2	-	-	-
CO 5	3	2	2	2	2	2	3	2	-	3	2	-	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Wave Optics: Huygen's principle –Super position of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light– Newton's rings– Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

UNIT-II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO_2; semiconductor laser – Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction–Applications.

Fiber Optics: Introduction – Construction – Principle – Propagation of light through an optical fiber – Numerical aperture and acceptance angle –Step-index and graded-index fibers –Pulse dispersion –Fiberlosses--Fiber optic communication system –Applications.

UNIT-III

Principles of Quantum Mechanics: Introduction – Wave nature of particles – de-Broglie hypothesis – Physical significance of ψ – Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave packets –Uncertainty principle – Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

UNIT-IV

Band Theory of Solids: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

UNIT-V

Semiconductors: Intrinsic and extrinsic semiconductors – Charge carrier concentration in intrinsic semiconductors – Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) – Carrier generation and recombination – Carrier transport: diffusion and drift – P-N junction – Thermistor – Hall effect – LED – Solar cell.

TEXT BOOKS:

1. B. K. Pandey and S. Chaturvedi, "Engineering Physics", Cengage Publications, 2012.
2. M. N. Avadhanulu and P. G. Kshirsagar, "A Text Book of Engineering Physics", S. Chand Publications, 2014.
3. M. Arumugam, "Materials Science", Anuradha Publications, 2015.
4. S. L. Gupta and Sanjeev Gupta, "Modern Engineering Physics", Dhanpat Rai Publications, 2011.

SUGGESTED READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, "Modern Physics", S. Chand Publications, 2014.
2. V. Rajendran, "Engineering Physics", Mc Graw-Hill Education Publications, 2013.
3. P. K. Palanisamy, "Engineering Physics", Scitech Publications, 2012.
4. V. Raghavan, "Materials Science and Engineering", Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

22CSC01N

PROBLEM SOLVING AND PROGRAMMING USING C

Instruction	2 L + 1 T Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Understanding the steps in problem solving and formulation of algorithms to problems.
2. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
3. Develop intuition to enable students to come up with creative approaches to problems.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Formulate solutions to problems and represent those using algorithms/ Flowcharts.
2. Choose proper control statements and data structures to implement the algorithms
3. Decompose a problem into modules and use functions to implement the modules.
4. Develop programs using arrays, pointers and structures.
5. Develop applications using file I/O.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	1	2	-	-	-	-	1	-	-	2	1	-
CO 2	3	2	1	2	-	-	-	-	1	-	-	2	1	-
CO 3	3	2	1	2	-	-	-	-	1	-	-	2	1	-
CO 4	3	2	-	2	-	-	-	-	1	-	-	2	1	-
CO 5	2	1	-	-	-	-	-	-	-	-	-	2	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction: Introduction to Programming, Idea of Algorithm, Representation of Algorithm, Flowchart, from algorithms to programs, source code.

Basics of C: Background, Structure of a C Program, Datatypes, Tokens, Operators and Expressions-Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions, Input and Output Functions.

UNIT-II

Control Statements: Conditional Execution -Selection Statements, Conditional Operator, Switch statement**.** Iteration Execution - While Construct, For Construct, do-while Construct Goto Statement, Special Control Statements, Nested Loops.

Arrays: One-Dimensional Arrays-Declaration, Initialization, internal representation. Multidimensional Arrays.

UNIT–III

Strings: Strings: One-dimensional Character Arrays, Arrays of Strings: Two-dimensional Character Array.**Functions:** Concept, Uses, Prototype, Declaration, Parameter passing techniques, Passing Arrays to Functions, Storage Classes, Recursion.

UNIT-IV

Search and Sorting: searching algorithms-linear, binary .sorting algorithms-bubble sort, selection sort.

Pointers: Declaring a Pointer, Initializing Pointers, Indirection Operator and Dereferencing, Arrays and

Pointers, Pointers and Strings, Pointers to Pointers, Array of Pointers, Pointers to an Array, Two-dimensional Arrays and Pointers, Pointers to Functions and Dynamic Memory Allocation.

UNIT–V

Userdefined Datatypes: Structures- Declaring Structures and Structure Variables, Accessing the Members of a Structure, Initialization of Structures, Typedef, Nesting of Structures, Arrays and Structures, Structures and Pointers, Structures and Functions, Union, Enumeration Types.

Files: Using Files in C, Declaration of File Pointer, Working with Text Files, Character Input and Output, Working with Binary Files, Sequential Versus Random File Access, File Record.

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh "Programming in C 2/e", 2nd Edition Oxford University Press, 2012.

SUGGESTED READING:

1. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language" Prentice Hall India, 2nd Edition. 1990.
2. B.A.Forouzan and R.F. Gilberg "A Structured Programming Approach in C", Cengage Learning,2007.
3. Byron Gottfried, "Schaum's Outline of Programming with C", McGraw- Hill.
4. E. Balaguruswamy, "Programming in ANSI C", Tata McGraw-Hill.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
2. https://archive.nptel.ac.in/courses/106/105/106105171/

22EGC01N

ENGLISH

(BE/B.Tech - Common to all Branches)

Instruction	2 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

PREREQUISITE: Basic knowledge of English grammar and vocabulary.

COURSE OBJECTIVES: This course aims to

1. Improve their understanding of communication skills while developing their usage of English for correct use of grammar and vocabulary.
2. Equip themselves with Reading Comprehension strategies and techniques.
3. Enhance their writing skills through paragraphs, précis and essays by using devices of cohesion and coherence.
4. Build appropriate, longer meaningful sentences for professional writing through formal letters and e-mails.
5. Demonstrate knowledge of drafting formal reports to define, describe and classify the processes by following a proper structure.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Step-up the awareness of correct usage of English grammar and vocabulary by speaking fluently and comprehensively with a grip on communication skills.
2. Apply effective reading techniques through critical reading exercises to enhance quality of life and to support lifelong learning.
3. Develop their ability to write paragraphs independently on any context with cohesion, edit essays coherently while realizing brevity through précis writing.
4. Construct sentences clearly and comprehensively to write effective business letters and draft emails for a better professional communication.
5. Advance efficiency in writing, distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1	2	2	3	3	2	3	1	1	3
CO 2	1	1	1	1	1	2	1	1	2	1	3	1	1	2
CO 3	1	2	1	1	-	2	1	1	3	1	3	1	1	2
CO 4	1	2	1	1	-	2	2	2	2	2	3	1	2	3
CO 5	1	2	1	2	1	3	2	3	3	2	3	2	1	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Communication Skills: Introduction, nature and importance of communication; Process of communication; Types of communication: verbal and non-verbal; Barriers to communication; Intrapersonal, Interpersonal communication; Understanding Johari Window. **Vocabulary & Grammar:** The concept of Word Formation - Root words, Use of prefixes and suffixes to form derivatives, Standard abbreviations. Basic Sentences. **Reading Task I.**

UNIT-II

Reading Skills: The Reading process, purpose, different kinds of texts; Reading Comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Practice in Critical Reading passages. **Vocabulary and Grammar:** Determiners. Use of Synonyms and Antonyms, Construction of Sentences. **Reading Task II.**

UNIT-III

Writing Skills II: Paragraph Writing. – Structure and features of a paragraph; Essay writing, Cohesion and coherence. Techniques of writing précis. **Vocabulary & Grammar:** Use of connectors and linkers, Tenses, Punctuation. **Reading Task III.**

UNIT-IV

Professional Writing Skills-1: Letter Writing – Structure, format of a formal letter; Letter of Request and Response, Drafting Emails, Email and Mobile etiquette. **Vocabulary and Grammar:** Phrasal verbs, Misplaced modifiers, Subject-verb agreement. **Reading Task IV**

UNIT-V

Professional Writing Skills-2: Report writing – Importance, structure, elements & style of formal reports; Writing a formal report. Writing for Blogs. **Vocabulary and Grammar:** Words often Confused, Common Errors. Avoiding Ambiguity & Redundancy. **Reading Task V.**

TEXT BOOKS:

1. Sanjay Kumar & Pushp Lata, "English Language and Communication Skills for Engineers", Oxford University Press,2018.
2. "Language and Life: A Skills Approach", Board of Editors, 2018th Edition, Orient Black Swan, 2018.

SUGGESTED READING:

1. Ashraf, M Rizvi, "Effective Technical Communication", Tata McGraw-Hill, 2006.
2. Michael Swan, "Practical English Usage", Oxford University Press, 4th Edition,2016.
3. Meenakshi Raman and Sangeetha Sharma, "Technical Communication: Principles and Practice" 3rd Edition, Oxford University Press, 2015.

22PYC03

OPTICS AND SEMICONDUCTOR PHYSICS LAB

(CSE, IT, CSE (AI&ML), CSE (IoT & Cyber Security including Block Chain Technology), AI&ML, AI&DS)

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to

1. Apply theoretical physics knowledge in doing experiments.
2. Understand the behaviour of the light experimentally.
3. Analyze the conduction behaviour of semiconductor materials and opto electronic devices.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Interpret the errors in the results of an experiment.
2. Demonstrate physical properties of light experimentally.
3. Make use of lasers and optical fibers for engineering applications.
4. Explain the V-I characteristics of some optoelectronic and semi conductor devices.
5. Find the applications of thermistor.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	3	1	3	3	3	-	1	2	-	-	-
CO 2	3	3	2	2	2	2	3	3	-	1	3	-	-	-
CO 3	3	3	3	3	3	1	3	3	-	1	2	-	-	-
CO 4	3	3	3	2	2	1	3	3	-	1	3	-	-	-
CO 5	3	2	2	3	2	1	3	3	-	1	2	-	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Error Analysis : Estimation of errors in the determination of time period of a torsional Pendulum
2. Fresnel's Biprism : Determination of wavelength of given monochromatic source
3. Newton's Rings : Determination of radius of curvature of a given plano-convex lens using Na vapor lamp
4. Single Slit Diffraction : Determination of wavelength of given monochromatic source
5. Diffraction Grating : Determination of wavelengths of two yellow lines of light of Mercury lamp
6. Laser : Determination of wavelength of given semiconductor laser
7. Holography : Recording and reconstruction of a hologram
8. Optical Fiber : Determination of numerical aperture and power losses of given optical fiber
9. Energy Gap : Determination of energy gap of given semiconductor
10. P-N Junction Diode : Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
11. Thermistor : Determination of temperature coefficient of resistance of given thermistor

12.	Hall Effect	:	Determination of Hall coefficient, carrier concentration and mobility ofcharge carriers of given semiconductor specimen
13.	LED	:	Study of I-V characteristics of given LED
14.	Solar Cell	:	Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance
15.	Planck's Constant	:	Determination of Planck's constant using photo cell

NOTE: A minimum of TWELVE experiments should be done.

22EGC02N

ENGLISH LAB

(BE/B.Tech - Common to all Branches)

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

PREREQUISITE: Basic Knowledge of English Communication.

COURSE OBJECTIVES: This course aims to

1. Nuances of Phonetics and give them sufficient practice in correct pronunciation through computer-aided multi-media instruction.
2. The significance and application of word and sentence stress and intonation.
3. Sufficient practice in listening to English spoken by educated English speakers in different socio-cultural and professional settings.
4. Reading and speaking activities enabling them to critically interpret and respond to different texts and contexts, and produce speech with clarity and confidence.
5. Team work, role behaviour while developing their ability to use language appropriately, to discuss in groups and make presentations.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Define the speech sounds in English and understand the nuances of pronunciation in English.
2. Produce speech with clarity and confidence using correct word and sentence stress, and intonation.
3. Achieve improved ability to listen, understand, analyse, and respond to English spoken in various settings.
4. Read, interpret, and review a variety of written texts, contexts, and perform appropriately in different situations.
5. Design effective posters collaboratively through creative decisions, give presentations, and efficiently participate in Group discussions.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	-	-	1	2	1	3	-	-	2
CO 2	-	-	-	-	-	-	-	2	2	1	3	-	-	2
CO 3	-	-	-	-	-	-	-	2	1	1	2	1	1	2
CO 4	1	1	1	1	1	1	1	3	3	1	3	1	1	3
CO 5	-	1	1	1	1	1	1	3	3	2	3	1	1	3

1 - Slightly, 2 - Moderately, 3 – Substantially

EXERCISES

Computer-Aided Language Learning Lab

1. **Introduction to English Phonetics**: Introduction to English Phonetics and organs of speech.
2. **Sound system of English**: Speech sounds- Vowels and Consonants- structure of syllables (Introduction to syllables) - Basic phonetic transcription practice.
3. **Word and Sentence stress**: Rules of word stress -Primary stress, Secondary stress; Sentence stress (word emphasis in sentences) -Practice.
4. **Intonation**: Types of Intonation, Practice in Articulation – MTI-Errors in pronunciation.
5. **Listening skills**: understanding Listening- Practice in Listening comprehension texts.

Interactive Communication Skills Lab

1. **JAM-** Ice Breaking, Speaking Activity**.**
2. **Role play/Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
3. **Group Discussions -** Dynamics of a Group Discussion, Group Discussion Techniques, Non-Verbal Communication.
4. **Read and Review** - Preparation for active reading and instructing the students to cultivate effective reading habits to read select texts, review and write their responses.
5. **Poster presentation –** Theme, poster preparation, team work and presentation.

TEXT BOOKS:

1. T Balasubramanian, "A Textbook of English Phonetics for Indian Students", Macmillan, 2nd Edition, 2012.
2. J Sethi et al., "A Practical Course in English Pronunciation (with CD)", Prentice Hall India, 2005.
3. Priyadarshi Patnaik, "Group Discussions and Interview Skills", Cambridge University Press Pvt. Ltd., 2nd Edition, 2015.
4. Aruna Koneru, "Professional Speaking Skills", Oxford University Press, 2018.

SUGGESTED READING:

1. "English Language Communication Skills – Lab Manual cum Workbook", Cengage Learning India Pvt. Ltd., 2022.
2. KN Shoba& J. Lourdes Javani Rayen."Communicative English – A workbook", Cambridge University Press, 2019.
3. Sanjay Kumar& Pushp. Lata. "Communication Skills: A Workbook. Oxford University Press", 2019.
4. Veerendra Mishra et al. "English Language Skills: A Practical Approach", Cambridge University Press, 2020.

Suggested Software:

1. K-VAN Multi-Media Language Lab
2. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).
3. Digital All
4. Orell Digital Language Lab (Licensed Version).

22CSC02N

PROBLEM SOLVING AND PROGRAMMING USING C LAB

Instruction	3 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to
1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.

COURSE OUCOMES: After the completion of this course, the student will be able to
1. Identify and setup program development environment.
2. Implement the algorithms using C programming language constructs.
3. Develop programs using arrays, structures and pointers.
4. Solve problems in a modular approach using functions.
5. Implement file operations with simple text data.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	1	1	1	-	-	-	-	1	-	-	1	1	-
CO 2	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO 3	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO 4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO 5	3	1	-	1	-	-	-	-	-	-	-	2	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

LABORATORY / PRACTICAL EXPERIMENTS:
1. Familiarization with programming environment.
2. Draw flowcharts using Raptor or Drakon Tool.
3. Simple computational problems using arithmetic expressions.
4. Problems involving if-then-else structures.
5. Iterative problems e.g., sum of series, generating patterns.
6. Iterative and Recursive functions.
7. 1D Arrays, 2D arrays and strings.
8. Sorting and Searching, Matrix problems.
9. Pointers and structures.
10. Dynamic memory allocation.
11. File Handling.

TEXT BOOKS:
1. Pradip Dey and Manas Ghosh “Programming in C 2/e”, 2nd Edition, Oxford University Press, 2012.

SUGGESTED READING:
1. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language”, 2nd Edition. Prentice Hall India, 1990.
2. B.A.Forouzan and R.F. Gilberg, “A Structured Programming Approach in C”, Cengage Learning,2007.
3. Byron Gottfried, “Schaum’s Outline of Programming with C”, McGraw- Hill.
4. E. Balaguruswamy, “Programming in ANSI C”, Tata McGraw-Hill.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
2. https://archive.nptel.ac.in/courses/106/105/106105171/

22MEC01N

ENGINEERING GRAPHICS

Instruction	1 T + 3 D Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

PREREQUISITE: Nil

COURSE OBJECTIVES: This course aims to
1. Get exposure to a cad package and its utility.
2. Understand orthographic projections.
3. Visualize different solids and their sections in orthographic projection.
4. Prepare the student to communicate effectively by using isometric projection.
5. Prepare the student to use the techniques, skills, and modern tools necessary for practice.

COURSE OUCOMES: After the completion of this course, the student will be able to
1. Become conversant with appropriate use of CAD software for drafting and able to draw conic sections.
2. Understand orthographic projections of points and straight lines.
3. Draw the projections of planes.
4. Draw and analyze the internal details of solids through sectional views.
5. Create an isometric projections and views.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	2	2	1	2	3	1	3			
CO 2	3	2	2	1	2	2	1	2	2	1	2			
CO 3	3	3	2	1	2	2	1	2	2	1	2			
CO 4	3	3	3	2	2	2	1	2	2	1	2			
CO 5	3	2	2	1	2	2	1	2	2	1	2			

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXERCISES:
1. Introduction to CAD package: Settings, draw, modify tools, dimensioning, documentation and practice exercises using Auto CAD software.
2. Construction of Conic Sections by General method.
3. Orthographic projection: Principles, conventions, Projection of points.
4. Projection of straight lines: Simple position, inclined to one plane & inclined to both the planes (without traces and mid-point)
5. Projection of planes: Perpendicular planes.
6. Projection of planes: Oblique planes.
7. Projection of solids: Simple position.
8. Projection of solids: Inclined to one plane.
9. Sections of solids: Prism, pyramid in simple position.
10. Sections of solids: Cone and Cylinder in simple position.
11. Isometric projections and views.
12. Conversion of isometric views to orthographic projections and vice-versa.

TEXT BOOKS:
1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt.Ltd,

2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

SUGGESTED READING:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

22MEC38N

DIGITAL FABRICATION WORKSHOP

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

PREREQUISITE: Nil

COURSE OBJECTIVES: This course aims to

1. Give a feel of Engineering Practices and develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive and team work attitude to get things right the first time.
3. Provide basic knowledge of steel, plastic, composite, and other materials for suitable applications.
4. Study of principle and hands on practice on techniques of fabrication, manufacturing, and allied skills.
5. Advance important, hard and pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in carpentry, house wiring and plumbing.
3. Make a given model by using workshop trades like carpentry, plumbing, House wiring and 3D modeling using solid works software for Additive Manufacturing.
4. Perform pre-processing operations on STL files for 3D printing, also understand reverse engineering process.
5. Conceptualize and produce simple device/mechanism of their choice.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	-	-	1	-	-	-	1			
CO 2	1	-	1	-	-	-	-	-	-	-	1			
CO 3	1	-	1	-	-	1	-	-	-	-	1			
CO 4	1	-	1	-	-	1	-	-	-	-	1			
CO 5	2	2	2	1	3	1	1	1	2	-	2			

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

Group 1: Workshop Practice

1. To make a lap joint on the given wooden piece according to the given dimensions.
2. To make a dovetail joint on the given wooden piece according to the given dimensions.
3. (a)Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single switch.
4. (b)Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket.
5. Stair case wiring of one light point controlled from two different places independently using two 2way switches.
6. To make external threads for GI pipes using die and connect the GI pipes as per the given

diagram using taps, couplings, and bends.

7. To connect the GI pipes as per the given diagram using, Coupling, Unions, reducers, and bends. To connect the GI pipes as per the given diagram using shower, tap, and valves and demonstrate by giving water connection.

Group 2: Additive Manufacturing /3D Printing

1. To Study the methods of Additive manufacturing process using a 3D printer.
2. To create a 3D CAD model of a door bracket using a modelling software.
3. To print a door bracket using an extruder type 3D printer.
4. To create a 3D CAD model using Reverse engineering.
5. Engraving, Drilling and Cutting operations on printed circuit boards using CNC PCB Mate.
6. To design an innovative component using the CAD software./print the selected innovative component by the student using a 3D printer.

TEXT BOOKS:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th Edition, Pearson Education India Edition, 2002.

SUGGESTED READING:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology.
2. Oliver Bothmann, 3D Printers: A Beginner's Guide, January 1, 2015.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT of COMPUTER SCIENCE AND ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION
(Inline with AICTE Model Curriculum with effect from AY 2024-25)
(R22A Regulation)

SEMESTER-II

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	22MTC04	Differential Equations and Numerical Methods	3	1	-	3	40	60	4
2	22CYC01	Chemistry	3	-	-	3	40	60	3
3	22EEC01	Basic Electrical Engineering	2	1	-	3	40	60	3
4	22ITC20N	Data Structures using C ++	3	-	-	3	40	60	3
PRACTICAL									
5	22CYC02	Chemistry Lab	-	-	3	3	50	50	1.5
6	22MBC02N	Community Engagement	-	-	2	-	50	-	1
7	22ITC21N	Data Structures using C++ Lab	-	-	2	3	50	50	1
8	22MEC37N	Robotics and Drones Lab	-	1	3	-	100	-	2.5
9	22EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
TOTAL			**11**	**3**	**12**	**-**	**460**	**390**	**20**

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

22MTC04

DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

Instruction	3 L + 1 T Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

COURSE OBJECTIVES: This course aims to

1. Explain the relevant methods to solve first order differential equations.
2. Explain the relevant methods to solve higher order differential equations.
3. Discuss numerical methods to solve algebraic and transcendental equations.
4. Discuss the interpolation and numerical differentiation.
5. Discuss convergence and divergence of Infinite series.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Calculate the solutions of first order linear differential equations.
2. Calculate the solutions of higher order linear differential equations.
3. Solve the algebraic, transcendental and system of equations.
4. Apply interpolation and numerical differentiation techniques for given data.
5. Test the convergence and divergence of Infinite series.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	-	-	-	-	-	-	2	-	1	-
CO 2	3	3	3	3	-	-	-	-	-	-	2	-	1	-
CO 3	2	2	2	2	-	-	-	-	-	-	1	-	2	-
CO 4	2	2	2	2	-	-	-	-	-	-	1	-	2	-
CO 5	1	1	1	1	-	-	-	-	-	-	1	-	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Differential Equations of First Order: Exact Differential Equations, Equations Reducible to Exact Equations, Linear Equations, Bernoulli's Equations, Riccati's and Clairaut's Equations, Orthogonal trajectories, Rate of decay of radio-active materials.

UNIT-II

Higher Order Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding Complementary function, Particular Integral and General solution. Method of Variation of Parameters, solution of Cauchy- Euler equation. LR and LCR circuits.

UNIT-III

Numerical solution of equations: Numerical solutions of algebraic and transcendental equations by Bisection method, Regula-falsi method and Newton-Raphson's method, Solution of system of linear equations by LU decomposition methods, Crout's method, Jacobi's method, Gauss Seidel method.

UNIT-IV

Interpolation and Numerical Differentiation: Forward, Backward and Central differences, Newton's forward and backward interpolation formulae, Gauss's forward and backward interpolation formulae, Lagrange's interpolation, Numerical differentiation at the tabulated points with forward, backward and central differences**.**

UNIT-V

Infinite Series: Convergence of sequence and series. Series of positive terms, Necessary condition for convergence, Comparison tests, limit form comparison test, D'Alembert's Ratio test, Raabe's test, Cauchy's root test, Alternating series, Leibnitz's rule, absolutely and conditionally convergence.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2011.
3. M.K. Jain, S.R.K Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineering and Computation", New age International Publications, 2008.

SUGGESTED READING:

1. R.K.Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publications, 2016.
2. Ramana B.V, "Higher Engineering Mathematics", 11th Reprint, Tata McGraw Hill New Delhi, 2010.
3. A.R.Vasishtha and R.K.Guptha, "Integral Transforms", Reprint, Krishna's Educational Publishers, 2014.

ONLINE RESOURCES:

1. NPTEL :: Mathematics - NOC:Advanced Calculus For Engineers (Week 5 & Week 6)
2. https://archive.nptel.ac.in/courses/111/107/111107105/ (Unit- 1,2,4 and 5)
3. https://archive.nptel.ac.in/courses/111/104/111104085/ (Infinite Series)

22CYC01

CHEMISTRY

(Common to CSE, CSE-AIML, AIML, CSE-IOT, AIDS)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

COURSE OUCOMES: Upon completion of this course, students will be able to

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	2	-	-	-	-	2	-	-	-
CO 2	3	2	2	-	-	2	-	-	-	-	2	-	-	-
CO 3	3	2	3	-	-	2	-	-	-	-	2	-	-	-
CO 4	3	2	3	-	-	2	-	-	-	-	2	-	-	-
CO 5	3	2	2	-	-	2	-	-	-	-	2	-	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2, He_2^+, N_2, O_2, O_2 , CO, NO). Pi- molecular orbitals of benzene and its aromaticity. **Chemical Kinetics:** Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II

Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs

Helmholtz equations and its applications). Cell potentials, electrode potentials, and – Reference electrodes (NHE, SCE) electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell.

UNIT-III

Stereochemistry and Organic reactions:

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism -Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) &Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds) Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides), Cyclization (Diels - Alder reaction)

UNIT–IV

Water Chemistry:

Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process), ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V

Engineering Materials and Drugs:

Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications. Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography. Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle). Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat 16th Edition Rai Publishing Company Ltd., New Delhi, (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", 7th Edition Pearson, Delhi, (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla ,Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READINGS:

1. B. H. Mahan, "University Chemistry", 3rd Edition Narosa Publishing house, New Delhi, (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", 46th Edition S. Nagin Chand & Company Ltd., (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", 12th Edition Wiley, (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", 8th Edition Oxford, (2006).

22EEC01

BASIC ELECTRICAL ENGINEERING

Instruction	2 L +1 T Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis.
2. Comprehend the basic principle of operation of AC and DC machines.
3. Infer about different types of electrical wires and cables, domestic and industrial wiring, safety rules and methods of earthing.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Understand the concepts of Kirchhoff's laws and their application various theorems to get solution of simple dc circuits.
2. Predict the steady state response of RLC circuits with AC single phase/three phase supply.
3. Infer the basics of single phase transformer.
4. Describe the construction, working principle of DC machine and 3-phase Induction motor.
5. Acquire the knowledge of electrical wires, cables, earthing, Electrical safety precautions to be followed in electrical installations and electric shock and its safety and energy calculations.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	-	-	-	-	1	2	-	3	1	1	-
CO 2	3	3	2	-	-	-	-	1	2	-	3	1	1	-
CO 3	3	3	2	1	-	-	-	1	2	-	3	-	-	-
CO 4	2	1	-	-	-	-	-	1	2	-	3	-	-	-
CO 5	2	-	2	-	-	-	-	1	2	-	3	1	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

DC Circuits: Electrical circuit elements (R,L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin's and Norton's Theorems.

UNIT-II

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, series RL and RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Single Phase Transformer: Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation

UNIT-IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt generators. DC Motors: Classification, Torque Equation,

Characteristics and Speed control of DC Shunt and Series Motors, Losses and efficiency Three - Phase Induction Motors: Principle of operation, Applications

UNIT-V

Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, and first aid for electric shock, safety rules. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption

TEXT BOOKS:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

SUGGESTED READING:

1. D. P. Kothari & I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989
3. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009
4. P.V. Prasad, S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013

22ITC20N

DATA STRUCTURES USING C++

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Problem Solving and Programming using C (22CSC01N), Problem Solving and Programming using C Lab (22CSC02N)

COURSE OBJECTIVES: This course aims to
1. Acquaint with OOP concepts.
2. Familiarize with the asymptotic analysis of Algorithms.
3. Learn sorting techniques.
4. Explore linear and nonlinear data structures.
5. Introduce pattern-matching algorithms and hashing.

COURSE OUCOMES: After the completion of this course, the student will be able to
1. Understand the concepts of OOPs.
2. Analyse the time complexity of operations on data structures.
3. Apply sorting techniques, pattern-matching algorithms, and hashing.
4. Demonstrate operations on linear and nonlinear data structures.
5. Develop solutions to the problems using linear and nonlinear data structures.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	1	-	-	-	-	-	1	2	3	3
CO 2	2	2	2	-	1	-	-	-	-	-	1	2	3	3
CO 3	2	2	2	-	1	-	-	-	-	-	1	2	3	3
CO 4	2	3	2	-	1	-	-	-	-	-	1	2	3	3
CO 5	2	3	2	-	1	-	-	-	-	-	1	2	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Object Oriented Design: Object-Oriented Design Goals, Object-Oriented Design Principles. **Classes:** Class Structure, Constructors and Destructor, Classes and Memory Allocation, Class Friends and Class Members, Standard Template Library. **Inheritance:** Inheritance in C++, Examples, Multiple Inheritance, Interfaces and Abstract Classes, Templates: Class Templates

UNIT-II

Algorithm Analysis: Experimental Studies, Primitive Operations, Asymptotic notation, Asymptotic Analysis, Seven functions. **Sorting**: Selection Sort, Insertion Sort, Merge-Sort: Divide-and-Conquer, Quick-Sort: Randomized Quick-Sort, Linear-Time Sorting: Bucket-Sort and Radix-Sort, Comparing Sorting Algorithms.

UNIT-III

Linked Lists: Singly Linked Lists, Implementing a Singly Linked List, Insertion to the Front of a Singly Linked List, Removal from the Front of a Singly Linked List, Implementing a Generic Singly Linked List, Doubly Linked Lists, Insertion into a Doubly Linked List, Removal from a Doubly Linked List, Circularly Linked Lists, Reversing a Linked List. **Stacks**: The Stack Abstract Data Type, a C++ Stack Interface, a Simple Array-Based Stack Implementation, Reversing a Vector Using a Stack,

Matching Parentheses. **Queues:** The Queue Abstract Data Type, a C++ Queue Interface, a Simple Array-Based Implementation, Implementing a Queue with a Circularly Linked List.

UNIT-IV

Trees: General Tree Definitions and Properties, Binary Trees, The Binary Tree ADT, Properties of Binary Trees, A Linked Structure for Binary Trees, A Vector-Based Structure for Binary Trees, Traversals of a Binary Tree, Representing General Trees with Binary Trees. **Binary Search Trees:** Searching, Update Operations, AVL Trees: Insertion; **Heaps:** The Heap Data Structure, Complete Binary Trees, Heap Sort.

UNIT-V

Strings: Pattern Matching Algorithms: Brute Force, the Boyer-Moore Algorithm, the Knuth-Morris-Pratt Algorithm. **Graphs:** Graphs, Data Structures for Graph, Graph Traversals. **Hash Tables**: Hash Tables, Bucket Arrays, Hash Functions, Hash Codes, Compression functions, Collision-Handling Schemes, Load Factors and Rehashing

TEXT BOOKS:

1. Michael T.Goodrich, Roberto Tamassia, David M.Mount, "Data Structure and Algorithms in C++", 2nd Edition, John Wiley, 2011.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", 5th Edition, Career Monk Publications, 2017.
3. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++" 2nd Edition, Universities Press, 2007.

SUGGESTED READING:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Addison-Wesley, 2007.
2. Narasimha Karumanchi, "Data Structures and Algorithms for GATE", Career Monk Publications, 2011.
3. D. Samantha, "Classic Data Structures", 2nd Edition, Prentice Hall India, 2013.

ONLINE RESOURCES:

1. NPTEL Videos: Introduction to data structures and algorithms - http://nptel.ac.in/courses/106102064/1
2. https://takeuforward.org/strivers-a2z-dsa-course/strivers-a2z-dsa-course-sheet-2/
3. https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/
4. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
5. https://visualgo.net/en

22CYC02

CHEMISTRY LAB

(Common to CSE, CSE-AIML, AIML CSE-IOT, AIDS)

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to

1. Impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. Provide the knowledge in both qualitative and quantitative chemical analysis.
3. Student should be conversant with the principles of volumetric analysis.
4. Apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. Interpret the theorical concepts in the preparation of new materials like drugs and polymers.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Identify the basic chemical methods to analyse the substances quantitatively and qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	2	-	-	-	-	2	-	-	-
CO 2	3	2	1	-	-	2	-	-	-	-	2	-	-	-
CO 3	3	2	3	-	-	2	-	-	-	-	2	-	-	-
CO 4	3	2	2	-	-	2	-	-	-	-	2	-	-	-
CO 5	3	2	3	-	-	2	-	-	-	-	2	-	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2} & Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution.
4. Determination of Alkalinity of water.
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order).
6. Determination of rate constant for the reaction between potassium per sulphate and potassium
7. Iodide. (Second order).
8. Estimation of amount of HCl Conductometrically using NaOH solution.
9. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids
10. Conductometrically using NaOH solution.
11. Estimation of amount of HCl Potentiometrically using NaOH solution.
12. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution
13. Preparation of Nitrobenzene from Benzene.
14. Synthesis of Aspirin drug and Paracetamol drug.
15. Synthesis of phenol formaldehyde resin.

TEXT BOOKS:

1. J. Mendham and Thomas, "Vogel's text book of quantitative chemical analysis", 6th Edition, Pearson education Pvt.Ltd. New Delhi, 2002.
2. B.D.Khosla, V.C.Garg & A.Gulati,; R., "Senior practical physical chemistry", Chand & Co. : New Delhi (2011).

SUGGESTED READING:

1. Dr. Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", 9th revised edition, S.Chand and Company, 2015.

22MBC02N

COMMUNITY ENGAGEMENT

Instruction	2 P Hours per Week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

COURSE OBJECTIVES: This course aims to

1. Develop an appreciation of rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Gain an understanding of rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	2	2	2	-	3	1	2	-	-	2			
CO 2	-	1	2	2	-	2	-	2	1	-	1			
CO 3	-	1	1	2	-	3	1	3	1	2	1			
CO 4	2	2	3	2	-	2	1	2	2	1	-			
CO 5	1	2	2	1	-	2	-	1	-	1	1			

1 - Slightly, 2 - Moderately, 3 – Substantially

Module I Appreciation of Rural Society:
Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources. Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood:
Agriculture, Farming, Landownership, Water management, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions:
Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees.

Module IV Rural Development Programmes:
History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India. NRLM, MNREGA etc.

TEXT BOOKS:

1. Singh, Katar, "Rural Development: Principles, Policies and Management", Sage Publications, New Delhi, 2015.
2. "A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies", 2002.

3. "United Nations, Sustainable Development Goals", 2015, un.org/sdgs
4. M.P Boraia, "Best Practices in Rural Development", Shanlax Publishers, 2016.

JOURNALS:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

22ITC21N

DATA STRUCTURES USING C++ LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

PREREQUISITE: Problem Solving and Programming using C (22CSC01N), Problem Solving and Programming using C Lab (22CSC02N).

COURSE OBJECTIVES: This course aims to
1. Acquaint with OOP concepts.
2. Learn sorting techniques.
3. Explore linear and nonlinear data structures.
4. Introduce pattern-matching algorithms
5. Explain hashing and Collision handling.

COURSE OUCOMES: After the completion of this course, the student will be able to
1. Practice the concepts of OOPs.
2. Define ADT for linear and nonlinear Data Structures.
3. Apply sorting techniques, pattern matching algorithm, and hashing.
4. Demonstrate standard operations on linear and nonlinear data structures.
5. Develop solutions to the problems using linear and nonlinear data structures.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	2	-	1	-	-	-	-	-	1	2	3	-
CO 2	2	2	2	-	1	-	-	-	-	-	1	2	3	3
CO 3	2	2	2	-	1	-	-	-	-	-	1	2	3	2
CO 4	2	2	2	-	1	-	-	-	-	-	1	2	3	1
CO 5	2	2	2	-	1	-	-	-	-	-	1	2	3	-

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF PROGRAMS:
1. Practice problems on Inheritance and Polymorphism.
2. Implement the following sorting techniques: Insertion Sort, Selection Sort, Merge Sort, Quick Sort.
3. Define Linked List ADT and implement its operations.
4. Implement Stack ADT and perform arithmetic expression evaluation.
5. Implement Queues, Circular Queues.
6. Implement Heap sort.
7. Construct a Binary Search Tree and implement Tree Traversals.
8. Define String ADT and implement the Boyer Moore pattern matching algorithm.
9. Implement Hashing with chaining.
10. Implement Graph Traversals.

TEXT BOOKS:
1. Michael T.Goodrich, Roberto Tamassia, David M.Mount, "Data Structure and Algorithms in C++", 2nd Edition, John Wiley, 2011.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", 5th Edition, Career Monk Publications, 2017.
3. Ellis Horowitz, Sartaj Sahni, Dinesh Mehta, "Fundamentals of Data Structures in C++" 2nd

Edition, Universities Press, 2007

SUGGESTED READING:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3rd Edition, Addison-Wesley, 2007.
2. D.Samantha, "Classic Data Structures", 2nd Edition, Prentice Hall India, 2013.

ONLINE RESOURCES:

1. https://takeuforward.org/strivers-a2z-dsa-course/strivers-a2z-dsa-course-sheet-2/
2. https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/

22MEC37N

ROBOTICS AND DRONES LAB

Instruction	1 T + 3 P Hours per Week
Duration of SEE	-
SEE	-
CIE	100 Marks
Credits	2.5

PREREQUISITE: Nil

COURSE OBJECTIVES: This course aims to

1. Develop a thorough understanding of various autonomous robot structures.
2. Gain expertise in working with various sensors and gain the ability to interface sensors with microcontrollers, read data, and seamlessly integrate them into robotics applications.
3. Acquire proficiency in understanding different types of motors, motor drivers, develop the skills to interface motors with microcontrollers, motors and construct two-wheel robots with controlled movements.
4. Attain proficiency in utilizing OpenCV for advanced image processing tasks master techniques such as RGB value extraction, creating colored shapes, and extracting Regions of Interest (ROI) from images.
5. Develop a thorough understanding of various drone structures/develop autonomous systems.

COURSE OUCOMES: After completion of this course, the student will be able to

1. Understand mechanical structures, motors, sensors, and circuits essential for constructing robots.
2. Demonstrate the utilization of sensors (Ultrasonic, IR, Rotary Encoder) for Arduino interfacing, reading data, and integrating them seamlessly into robotics applications.
3. Demonstrate expertise in operating robot controllers, applying theory to precisely control servo and stepper motors, 2 wheel robots ensuring desired motion.
4. Able to apply Python and OpenCV for image processing, including RGB extraction and ROI tasks.
5. Proficiently assemble a quadcopter drone, showcasing understanding of its classification, parts, and operational principles/ Proficiency to develop autonomous systems fostering creativity and practical application.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	1	1	-	1	3	3	1	2			
CO 2	1	2	2	1	1	-	1	3	3	1	2			
CO 3	1	2	2	1	1	-	1	3	3	1	2			
CO 4	2	2	2	1	1	-	1	3	3	1	2			
CO 5	2	2	2	1	1	-	1	3	3	1	2			

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

Experiment No	Title	CO
1.	Introduction to Robotics, Definition and scope of robotics, Robot configurations- Cartesian, cylinder, polar and articulate. Uses and Significance of Robots, Parts of a Robot, Current applications and future trends. Introduction to Arduino, C++, Arduino Programming Environment. Interfacing Arduino with Electronic Devices such as LEDs/Piezo Buzzer.	1
2.	Interfacing Arduino with Electronic Devices such as Push Button/Potentiometer.	1

3.	Introduction to Sensors, Types of Sensors, Reading Data from Sensors, Interfacing Sensors with Microcontrollers. Interfacing Arduino with Ultrasonic Distance Sensor and Reading Sensor Data on Serial Monitor.	2
4.	Interfacing Arduino with IR Sensor and Reading Sensor Data on Serial Monitor.	2
5.	Interfacing Arduino with Rotary Encoder and Reading Sensor Data on Serial Monitor.	2
6.	Introduction to motors, Types of motors, Motor drivers, Interfacing motors with Microcontrollers, Introduction to Li-ion, LIPO batteries, uses and safety precaution. Implement a system that utilizes an Arduino microcontroller to control the precise movement of a servo motor.	3
7.	Implement a system that utilizes an Arduino microcontroller to control the precise and sequential movements of a stepper motor.	3
8.	Construct a two-wheel robot using DC motors controlled by an Arduino microcontroller. Implement a program that allows the robot to execute specific movements. The robot should: i. Move forward with controlled acceleration. ii. Move backward with controlled deceleration.	3
9.	Construct an Obstacle avoidance robot.	3
10.	Construct a Pick and place robot.	3
11.	OpenCv for image processing: i. Extraction of RGB values of a pixel ii. Create colored shapes and save image iii. Extraction of ROI	4
12.	Assembly of quad copter drone.	5

Open-Ended Project on Autonomous System

Note:

- Mandatory Open-Ended Project (20 marks) in CIE.
- Any 10 experiments the students must do among the 12 experiments.

SUGGESTED READING:

1. https://www.geeksforgeeks.org/robotics-introduction/
2. https://www.ohio.edu/mechanical-faculty/williams/html/PDF/IntroRob.pdf
3. https://www.idtechex.com/en/research-report/new-robotics-and-drones-2018-2038-technologies-forecasts-players/584
4. https://dronebotworkshop.com/

22EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

COURSE OBJECTIVES: This course aims to

1. Acquire the knowledge on different types of electrical elements and to verify the basic electrical circuit laws and theorems.
2. Determine the parameters and power factor of a coil, calculate the time and frequency responses of RLC circuits and to familiarize with measurement of electric power & energy.
3. Determine the characteristics of Transformers, dc, ac machines and switch gear components.

COURSE OUCOMES: After the completion of this course, the student will be able to

1. Comprehend the circuit analysis techniques using various circuital laws and theorems.
2. Analyse the parameters of the given coil and measurement of power and energy in AC circuits
3. Determine the turns ration/performance parameters of single-phase transformer.
4. Infer the characteristics of DC shunt motor different tests.
5. Illustrate different parts and their function of electrical components, equipment and machines.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	2	-	-	-	-	2	-	-	-
CO 2	3	2	1	-	-	2	-	-	-	-	2	-	-	-
CO 3	3	2	3	-	-	2	-	-	-	-	2	-	-	-
CO 4	3	2	2	-	-	2	-	-	-	-	2	-	1	1
CO 5	3	2	3	-	-	2	-	-	-	-	2	-	1	1

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:

1. Verification of KCL and KVL.
2. Verification of Thevenin's theorem.
3. Verification of Norton's theorem.
4. Charging and discharging of Capacitor.
5. Determination of parameters of a choke or coil by Wattmeter Method.
6. Power factor improvement of single-phase AC System.
7. Active and Reactive Power measurement of a single-phase system using
   (i) 3-Ammeter method (ii) 3-Voltmeter method
8. Measurement of 3-Phase Power in a balanced system.
9. Calibration of single-phase energy meter.
10. Verification of Turns/voltage ratio of single-phase Transformer.
11. Open Circuit and Short Circuit tests on a given single phase Transformer.
12. Brake test on DC Shunt Motor.
13. Speed control of DC Shunt Motor.
14. Demonstration of Measuring Instruments and Electrical Lab components.
15. Demonstration of Low-Tension Switchgear Equipment/Components
16. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: TEN experiments to be conducted to cover all five COURSE OUCOMES.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT of COMPUTER SCIENCE AND ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION
(Inline with AICTE Model Curriculum with effect from AY 2025-26)
(R22A Regulation)

SEMESTER – III

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
11.	22ITC02N	Java Programming	3	-	-	3	40	60	3
12.	22CSC06	Discrete Structures	4	-	-	3	40	60	4
13.	22CSC07N	Digital Logic Design	3	-	-	3	40	60	3
14.	22CSC14N	Design and Analysis of Algorithms	3	-	-	3	40	60	3
15.	22ECC36	Basic Electronics and Sensors	3	-	-	3	40	60	3
16.	22EGM01	Indian Constitution and Fundamental Principles	2	-	-	2	-	50	Non Credit
PRACTICAL									
17.	22ITC03N	Java Programming Lab	-	-	3	3	50	50	1.5
18.	22CSC47	Python Programming Workshop	-	-	3	3	50	50	1.5
19.	22ECC37	Basic Electronics and Sensors Lab	-	-	2	3	50	50	1
20.	22CSI01N	Moocs / Training / Internship	3 to 4 weeks / 90 Hours			-	50	-	2
		TOTAL	**18**	**-**	**8**	**-**	**400**	**500**	**22**
Clock Hours Per Week: 26									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

22ITC02N

JAVA PROGRAMMING

(Common to CSE, IT, AI&DS, CET and allied branches)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Introduce the fundamental concepts of Object-Oriented Programming (OOP).
2. Guide students through the process of creating and managing classes and objects.
3. Explain and demonstrate the use of inheritance and polymorphism.
4. Teach effective handling of runtime exceptions and the basics of multithreading.
5. Provide hands-on experience with Java's IO package for application development.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Apply OOP concepts to develop structured Java applications.
2. Utilize inheritance and interfaces to enhance code reusability and flexibility.
3. Implement exception handling and multithreading to manage complex program flows.
4. Build applications using the Java Collection Framework.
5. Develop programs that handle input and output operations using the IO package.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	3	2	2	-	1	2	1	2	2	2	2
CO 2	2	2	3	2	2	1	-	1	2	1	2	2	2	2
CO 3	2	2	3	2	2	1	-	1	2	1	2	2	2	2
CO 4	2	2	3	2	2	1	-	1	2	1	2	2	2	2
CO 5	2	2	3	2	3	1	-	1	2	1	2	2	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to Java: Procedural and object-oriented programming paradigms, Principles, Features, Basic structure a java program, Java Primitive Data Types, Basic Operators, Flow-control statements. Defining Classes, Adding Instance Fields and Methods, Object Creation, Constructors, Access Modifiers, Method Overloading and Constructor Overloading, Use of static and final keyword, Arrays, Strings and String Tokenizer. Scanner.

UNIT-II

Inheritances and Packages: Types of Inheritance, super keyword, preventing inheritance, the Object class, method overriding and dynamic method dispatch, abstract classes and methods. Interfaces, Interfaces vs. Abstract classes, Inner classes and types, Packages, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

UNIT-III

Exception Handling and Threading: What are exceptions, Error vs. Exception, usage of try, catch, throw, throws and finally clauses, Multithreading in Java, Life cycle of Thread, how to create threads, Thread class in java, Thread priorities, Thread Synchronization. Introduction to Generics, Advantages of Generics, Generic class, Type Parameters, Generic Methods.

UNIT-IV

Collections: Overview of Java Collection Framework, Collection Interfaces – Collection, Set, List, Map, Collection classes – Array List, Linked List, Hash Set, Tree Set, Hash Map, Tree Map, Iteration over Collections – Iterator and List Iterator, Comparable and Comparator interface, Introduction to Java 8 Features, Lambda Expressions, Functional Interfaces.

UNIT-V

Java I/O and NIO: Input Stream, Output Stream, Reader, Writer, File Reader, File Writer, Buffered Reader, Buffered Writer, Object Serialization and Deserialization, Java NIO: Non-blocking I/O, Path, Files, Selectors, Channels, Buffers, Asynchronous I/O, NIO vs. IO

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, Tata McGraw Hill Publications, 2020.
2. K Somasundaram "Advanced Programming in Java2" Jaico Publishing House, 2008.

SUGGESTED READING:

1. E Balaguruswamy, "Programming with Java", 6th Edition, TataMcGraw-Hill, 2019.
2. Paul Deitel and Harvey Deitel, "Java How to Program, Early Objects ", 11th Edition., 2018.

ONLINE RESOURCES:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2

22CSC06

DISCRETE STRUCTURES

Instruction	4 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

COURSE OBJECTIVES: This course aims to
1. Introduce Propositional and Predicate Logic.
2. Introduce various proof techniques for validation of arguments.
3. Develop an understanding of counting, functions and relations.
4. Familiarize with fundamental notions and applicability of graph theory and algebraic systems.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Describe rules of inference for Propositional and Predicate logic.
2. Demonstrate use of Set Theory, Venn Diagrams, relations, and functions in Real-world scenarios.
3. Model solutions using Generating Functions and Recurrence Relations.
4. Determine the properties of graphs and trees to solve problems arising in computer science applications.
5. Distinguish between groups, semi groups and monoids in algebraic systems

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	1	1	-	-	-	-	1	-	-	1	-	-
CO 2	2	1	-	1	-	-	-	-	-	-	1	1	-	-
CO 3	2	2	-	1	-	-	-	-	-	-	-	1	-	-
CO 4	2	1	-	1	-	-	-	-	1	-	-	1	-	-
CO 5	2	1	-	1	-	-	-	-	-	-	-	1	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT – I

Introduction to Propositional Calculus: Basic Connectives and Truth tables, Logical Equivalence: Laws of Logic, Logical Implication; Rules of Inference. **Predicates:** The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems

UNIT – II

Sets: Sets and Subsets, Operations on sets and the Laws of Set Theory, Counting and Venn Diagrams. **Relations and Functions:** Cartesian Products and Relations. Partial ordering relations, POSET, Hasse diagrams, Lattices as Partially Ordered Sets, Equivalence relations. Pigeon hole principle. **Functions**: Types of Functions, Composition of functions and Inverse of functions

UNIT – III

Fundamental Principles of counting: The Rules of Sum and Product, Permutations, Combinations, Binomial Theorem; **Generating Functions**: Generating Functions, Calculating Coefficient of generating functions; **Recurrence Relations:** The First Order Linear Recurrence Relation, Second Order Linear. Homogeneous Recurrence relations with constant coefficients, Non Homogeneous Recurrence relations.

UNIT – IV

Introduction to Graphs: Graphs and their basic properties- degree, path, cycle, Sub graphs, Complements and Graph Isomorphism, Euler trails and circuits, Hamiltonian paths and cycles, Planar

graphs, Euler formula, Graph Coloring and Chromatic polynomial, Matching, Applications. **Trees**: Definitions, Properties, Rooted Trees, Spanning Trees, Minimum Spanning trees: Algorithms of Kruskal and Prim.

UNIT - V

Algebraic Structures: Algebraic Systems, Examples and General Properties, Semi groups and Monoids. **Groups:** Definitions and Examples, Subgroups, Homomorphisms and cyclic groups

TEXT BOOKS:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", An Applied Introduction, 5th edition, Pearson Education, 2016.
2. Rosen, K. H., "Discrete Mathematics and Its Applications", 8th Edition, ISBN10: 125967651X ISBN13: 9781259676512, 2019

SUGGESTED READING:

1. Singh, S.B., "Discrete Mathematics", Khanna Book Publishing Company, New Delhi., 3rd Edition, 2019
2. R. K. Bisht, H. S. Dhami, "Discrete Mathematics", Oxford University Press, 2015.
3. David D. Railey, Kenny A. Hunt, "Computational Thinking for the Modern Problem Solving", CRC Press, 2014
4. J. P. Tremblay, R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", TATA Mc Graw-Hill Edition, 1995.
5. Joe L. Mott, Abraham Kandel, Theodore P. Baker, "Discrete Mathematics for Computer Scientists & Mathematicians", 8th Edition, PHI, 1986

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111107058/
2. https://nptel-discrete-mathematics-5217

22CSC07N

DIGITAL LOGIC DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to
1. Learn the basic building blocks of digital hardware and various minimization techniques.
2. Analyse and design the Combinational and Sequential circuits.
3. Design the circuits using registers, counters state reduction methods.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Demonstrate the number system conversions and simplify Boolean functions.
2. Apply basic theorems and properties of Boolean algebra to represent logical functions in canonical and standard forms.
3. Analyze and simplify Boolean expressions using Karnaugh-maps and tabulation method.
4. Analyze and Design various combinational circuits and Sequential circuits using logical gates and flipflops.
5. Design different applications using registers, counters and state reduction methods.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	1	-	-	-	-	-	-	-	1	1	-
CO 2	3	1	2	2	-	-	-	-	-	-	-	2	1	2
CO 3	3	1	2	2	-	-	-	-	-	-	-	2	1	2
CO 4	-	1	1	1	-	-	-	-	-	-	-	1	1	-
CO 5	-	-	2	1	-	-	-	-	-	-	-	1	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Digital and Binary Numbers: Digital systems, Binary numbers, Number base conversions, Octal and Hexadecimal numbers, Complements of Numbers, Binary codes. **Boolean Algebra and logic Gates:** Binary logic, Basic Definitions, Axiomatic Definition of Boolean Algebra, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Canonical and Standard Forms, Other Logic Operations, Digital Logic Gates, Integrated Circuits.

UNIT – II

Minimization of Switching Functions: Introduction, the map method, minimal functions and their properties, the tabulation procedure, the prime implicant chart. **NAND and NOR Gates:** NAND Circuits, Two-level Implementation, Multilevel NAND Circuits, NOR Circuits. Exclusive OR Gates: Odd Function, Parity Generation and Checking.

UNIT- III

Combinational Logic Design: Combinational Circuits; Analysis **Procedure:** Derivation of Boolean Functions, Derivation of the Truth Table, Logic Simulation. **Design Procedure:** Decoders, Encoders, Multiplexers - Designing Combinational Circuits using Multiplexers, Binary Adders, Adder-Subtractor, Binary Multiplier.

UNIT - IV

Sequential Circuits: Sequential circuit definitions, Latches, Flip Flops, Sequential circuit analysis,

Sequential circuit design, Design with D Flip Flops, Designing with JK Flip-Flops.

UNIT – V

Sequence Detection and State Reduction Methods: Moore and Mealy state graphs for sequence detection, Methods for reduction of state tables, Methods for state assignment. **Registers:** Registers, Shift registers. **Counters:** Ripple counters, synchronous counters, and other counters.

TEXT BOOKS:

1. Morris Mano M. and Michael D. Ciletti, "Digital Design, With an Introduction to Verilog HDL", 5th Edition, Pearson 2013.
2. ZVI Kohavi, "Switching and Finite Automata Theory", 2nd Edition, Tata McGraw Hill, 1995.

SUGGESTED READING:

1. Roth, Jr., Charles H., et al. "Fundamentals of Logic Design", Enhanced Edition, Singapore, Cengage Learning, 2020.
2. Ronald J Tocci, Neal Widmer, Greg Moss, "Digital Systems: Principles and Applications", 11th Edition, Pearson 2011.
3. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with VHDL design, 2nd Edition, McGraw Hill, 2009.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ee39/preview

22CSC14N

DESIGN AND ANALYSIS OF ALGORITHMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Basics of Data structures and algorithms.

COURSE OBJECTIVES: This course aims to

1. Provide an introduction to formalisms to understand, analyze and denote time complexities of algorithms.
2. Introduce the different algorithmic approaches for problem solving through numerous example problems.
3. Provide some theoretical grounding in terms of finding the lower bounds of algorithms and the NP-completeness.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Identify and apply asymptotic notations and recurrence-solving techniques to analyze the performance of recursive algorithms
2. Apply greedy and dynamic programming strategies to solve optimization problems and identify the most suitable design approach based on problem characteristics.
3. Implement backtracking and branch-and-bound techniques to solve combinatorial and decision problems and evaluate their efficiency.
4. Solve and evaluate the performance of graph traversal and shortest path algorithms.
5. Demonstrate NP-completeness through problem reductions and complexity classes.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	2	1	-
CO 3	3	3	2	-	-	-	-	-	-	-	-	2	1	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	2	-	-
CO 5	2	3	-	1	-	-	-	-	-	-	-	2	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Introduction: Characteristics of algorithm. **Analysis of algorithm:** Asymptotic analysis of complexity bounds – best, average and worst-case behavior. Performance measurements of Algorithm, Time and space trade-offs. **Divide and Conquer:** The general method, Minimum and Maximum Problem **Analysis of recursive algorithms through recurrence relations:** Iterative/Expansion method, Recursion tree method and Masters' theorem.

UNIT - II

Greedy Algorithms: The general method, Knapsack Problem, Huffman Codes, Job scheduling with deadlines. **Dynamic Programming**: The general method, 0/1 Knapsack, Travelling Salesman Problem, Matrix chain multiplication, Longest Common subsequence.

UNIT - III

Backtracking: The general Method, 8-Queens Problem, Graph Coloring, Hamiltonian Cycle. **Branch-and-Bound**: The general method, FIFO branch and bound, LC branch and bound, 0/1 Knapsack Problem using FIFO branch and bound, Travelling Salesperson problem using LC branch and bound.

UNIT - IV

Graph Algorithms: Applications of DFS: Bi-Connected components, strongly connected components, topological sorting. **Shortest Path Algorithms**: Dijkstra's, Bellman-Ford, Floyd-Warshall

UNIT - V

Theory of NP-Completeness: Polynomial time, Polynomial time verification, P, NP, NP-hard and NP-Complete classes, NP-Completeness and Reducibility. **Standard NP-Complete Problems and Reduction Techniques:** The Clique Problem, Vertex-Cover Problem.

TEXT BOOKS:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 4th Edition, 2022.
2. E. Horowitz, sartaj sahni and sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", Universities Press, 2008.

SUGGESTED READING:

1. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis", and Internet Examples, Wiley Second Edition.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106101060/

22ECC36

BASIC ELECTRONICS AND SENSORS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Concepts of Semiconductor Physics and Applied Physics.

COURSE OBJECTIVES: This course aims to

1. Describe semiconductor device's principles and understand the characteristics of junction diode and transistors.
2. Understand working principles of Analog to Digital and Digital to Analog conversion.
3. Understand Interfacing of various modules myRIO.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Identify various types of semiconductor devices for building electronic circuits.
2. Describe the operation of various sensors, data convertors and actuators.
3. Acquire the data from various sensors.
4. Analyse usage of sensors/actuators for the development of real-time applications.
5. Apply theoretical learning to implement practical real-time problems for automation.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1	1	3	3	2	1	2	1	1	1
CO 2	3	3	3	1	1	1	2	3	2	2	2	1	1	1
CO 3	3	2	2	1	2	2	1	3	2	2	2	1	1	1
CO 4	3	3	3	3	1	2	2	3	2	2	2	1	1	1
CO 5	3	3	3	2	1	2	2	3	2	2	2	1	1	1

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Diodes and its Applications: Overview of Semiconductors, Characteristics of P-N Junction diode, current equation. Characteristics of Zener Diode, Voltage regulator, Half Wave, Full Wave: Center tap, Bridge Rectifiers. **Display Systems:** Constructional details of C.R.O and Applications.

UNIT-II

Bipolar Junction Transistors: Classification, Bipolar Junction Transistors Configurations. CE, CB Characteristics, h-parameters, Analysis of BJT amplifier using h-parameters in CE, CB configuration.
Field Effect Transistor: Junction Field Effect Transistor: Principle of Operation, Characteristics of JFET and Operation of MOSFET.

UNIT- III

Op-Amps Circuits: Basic Principle, Ideal, and practical Characteristics, Voltage Follower, Op-Amp parameters, Applications-Summer, Integrator, Differentiator, Instrumentation amplifiers, Logic Gates-IC's. **Data Converters:** Specifications, DAC- Weighted Resistor, R-2R Ladder, ADC-Parallel Comparator., Successive Approximation and Dual Slope(Qualitative treatment Only).

UNIT-IV

Sensors: Definition, classification, Proximity Sensors, Tachogenerator as a Velocity, Optical encoder as motion and Strain Gauge as force Sensor; Temperature and light sensors, Collision Avoidance

sensors. **ROBOT Sensors:** Sensors in robot – Touch sensors; Camera Systems in Machine: Camera Technology, History in Brief, Machine Vision versus closed Circuit Television (CCTV). **Actuators:** Introduction, Types of actuators in IOT, Real life examples of actuators in IOT.

UNIT-V

Hardware/software platforms: Introduction to LabVIEW, Data Acquisition System: hardware Overview of my RIO, Converting Raw Data Values to a Voltage. **Sensors interfacing with my RIO:** Introduction, Pin configuration, diagrams of thermistor, photo cell, Hall Effect, IR Range Finder, Bluetooth, Temperature Sensors.

TEXT BOOKS:

1. Robert L.Boylestad, Louis Nashelsky, "Electronic Devices and Circuits Theory", 9th Edition, Pearson Education, LPE, Reprinted, 2006.
2. D Patranabis, Sensors and Transducers, 2nd Edition, PHI, 2013.
3. DVS Murthy, Transducers and Instrumentation, 2nd Edition, PHI, 2013.
4. Ed Doering, NI myRIO Project Essentials Guide, Feb. 2016.

SUGGESTED READING:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, 4th Edition, PHI, 2012.
2. Anindya Nag, Subhas Chandra Mukhopadhyay, Jurgen Kosel, Printed Flexible Sensors: Fabrication, Characterization and Implementation, Springer International Publishing, Year: 2019, ISBN: 978-3-030- 13764-9,978-3-030-13765-6.
3. User guide and specifications NI myRIO-1900.

22EGM01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	Non Credit

PREREQUISITE: Basic awareness of Indian Constitution and Government.

COURSE OBJECTIVES: This course aims to

1. Understand the history of framing of the Indian Constitution.
2. Awareness on Fundamental Rights, Duties and Directive Principles of State Policy.
3. Explore the organization of Union Government, and functions of President and Prime Minister.
4. Gain an insight into the inter-functionality of Union Legislature and Judiciary.
5. Educate on the local governance and problems in development of rural and urban areas.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the history of framing of the Indian Constitution and its features.
2. Assess the realization of Fundamental Rights and Directive Principles of State Policy.
3. Analyze the challenges to federal system and position of the President and the Prime Minister in the Union Government.
4. Underline the role of the Legislature and the Judiciary in Union Government and their mutual relations.
5. Evolve the development of the local governments in India and assess the role of Collector in district administration.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	-	1	-	-	1	1	1	-	-	-	-	-	-
CO 2	-	-	2	-	-	3	2	1	-	-	-	-	-	-
CO 3	-	-	1	-	-	1	-	-	-	-	-	-	-	-
CO 4	-	-	1	-	-	1	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	3	1	1	-	-	-	-	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Constitutional History and Framing of Indian Constitution: East India Company rule (1757-1857): Social, Economic, Political and Administrative impact of Company rule in India. British Rule (1858-1947): Indian National Movement, Government of India Acts 1909, 1919 and 1935, and Indian Independence Act 1947. Framing of the Indian Constitution: Constituent Assembly, Preamble and Salient Features.

UNIT-II

Fundamental Rights, Duties and Directive Principles of State Policy: The Fundamental Rights**:** Features and significance of Rights. Fundamental Duties: Importance and the legal status of Duties. Directive Principles of State Policy: Socialist, Gandhian and Liberal-intellectual principles, importance and relevance.

UNIT-III

Union Government and its Administration: Federalism: Division of legislative and financial powers between the Union and the State. Union Executive: Role and position of President, Prime Minister and Council of Ministers. Emergency Provisions: National Emergency, Constitutional Emergency and Financial Emergency.

UNIT-IV

Union Legislature and Judiciary: Union Legislature: Parliament of India-Composition and functions of Parliament, and Parliamentary Committees. Union Judiciary: Supreme Court of India-Composition and Functions.

UNIT-V

Local Self Governments: Rural Local Governments: Zilla Parishad- CEO and functions of Zilla Parishad, Mandal Parishad- Role of Elected and Officials, Gram Panchayat- Sarpanch, Secretary and Gram Sabha. Urban Local Governments: Structure and functions of Municipalities and Municipal Corporations. District Collector: Powers and functions of Collector.

TEXT BOOKS:

1. Sastry Ravindra, (Ed), "Indian Government & Politics", 2nd Edition, Telugu Akademy, 2018.
2. "Indian Constitution at Work", 1st Edition 2006, NCERT, reprinted in 2022.

SUGGESTED READING:

1. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st Edition, 2015.
3. Granville Austin, "The Indian Constitution: The Cornerstone of a Nation", 2nd Edition, OUP, 1999.
4. M.V. Pylee, "India's Constitution", 16th Edition, S. Chand Publishing, 2017.
5. Rajeev Bhargava (ed), "Politics and Ethics of the Indian Constitution", OUP, 2008.

ONLINE RESOURCES:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

22ITC03N

JAVA PROGRAMMING LAB

(Common to CSE, IT, AI&DS, CET and allied branches)

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to

1. Introduce the core principles of Object-Oriented Programming (OOP).
2. Explain the object-oriented approach to designing and implementing classes and objects.
3. Demonstrate the use of inheritance and polymorphism in Java.
4. Illustrate exception handling and multithreading techniques for managing runtime behaviour.
5. Explore Java's IO package for developing basic input/output functionalities in applications.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Apply OOP principles to design and develop Java applications.
2. Implement inheritance and interfaces to build modular and reusable code.
3. Use exception handling and multithreading to manage multiple execution paths efficiently.
4. Develop robust applications utilizing the Java Collection Framework.
5. Integrate Java IO concepts for effective data input and output operations in applications.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	3	2	2	-	1	2	1	2	2	2	2
CO 2	3	3	3	2	2	1	-	1	2	2	2	2	2	2
CO 3	2	2	3	2	2	1	-	1	2	1	2	2	2	2
CO 4	2	2	3	2	2	1	-	1	2	1	2	2	2	2
CO 5	3	3	3	2	3	1	-	1	2	2	2	2	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Implement the program(s) to handle the various data types, operators, expressions, control-flow, and strings.
2. Develop a java program(s) for constructors.
3. Develop a java program to demonstrate the method overloading and riding.
4. Develop a java program(s) to deal with different types of inheritances and interfaces.
5. Implement the program(s) to demonstrate the packages.
6. Develop a java program(s) to handle user defined exceptions with multiple catch blocks.
7. Implement program(s) to demonstrate Multithreading and thread synchronization.
8. Implement program(s) to demonstrate generics.
9. Implement the collection framework classes with Iterator/List Iterator.
10. Develop a java program(s) to implement the features of JDK8.

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, Tata McGraw Hill Publications, 2020.
2. K Somasundaram "Advanced Programming in Java2" Jaico Publishing House, 2008.

SUGGESTED READING:

1. E Balaguruswamy "Programming with Java", TataMcGraw-Hill, 6th Edition, 2019.

2. Paul Deitel and Harvey Deitel "Java How to Program, Early Objects", 11th Edition. 2018.

ONLINE RESOURCES:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html
2. https://nptel.ac.in/courses/106106147/2

22CSC47

PYTHON PROGRAMMING WORKSHOP

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

PREREQUISITE: Programming for Problem Solving.

COURSE OBJECTIVES: This course aims to

1. Enable students to set up the Python environment and develop basic programs using input/output operations and fundamental data types.
2. Familiarize students with control flow mechanisms using conditional statements and iterative loops for efficient program execution.
3. Promote modular programming through the use of user-defined functions, collections (lists, tuples, dictionaries), and file handling techniques. And introducing object oriented programming concepts.
4. Design and construct simple programs by using the different design strategies for solving different problems.
5. Enhance programming skills while improving their practical knowledge in implementing the algorithms.

COURSE OUTCOMES: After the completion of this course, the student will be able to:

1. Demonstrate the basic Python syntax, variables, data types (integers, floats, strings, Boolean), and operators.
2. Develop Python programs using control structures, user-defined functions with appropriate parameters, and collection types (lists, tuples, dictionaries) to solve real-time problems efficiently.
3. Apply file handling operations and implement object-oriented programming features such as classes, objects, inheritance, and exception handling to build applications. Design and implement modular Python code using packages, sub packages, functions and classes to enhance reusability.
4. Develop solutions for optimization problems like Fractional Knapsack, Job Scheduling using Greedy algorithms.
5. Solve problems like longest common subsequence, N-Queens, and graph coloring using dynamic programming and backtracking.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-	2	-	-	-	-	-	-	2	2	3
CO 2	3	2	2	2	3	-	-	-	2	-	-	2	2	2
CO 3	3	2	2	2	3	-	-	-	-	-	-	2	3	2
CO 4	2	3	2	-	-	-	-	-	-	-	-	2	2	-
CO 5	2	3	2	-	-	-	-	-	-	-	-	2	2	-

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Set up the Python environment and write the first Python program using print statements. Explore input/output operations and Develop Python programs using various data types (int, float, string, boolean) and apply arithmetic, relational, logical, and assignment operators.
2. Implement conditional statements (if, elif, else) to control the program flow based on user inputs and create programs on for and while loops for iterating over sequences and repeating tasks with controlled conditions. Define user-defined functions with parameters and return values to create modular and reusable program components.

3. Create and manipulate core Python collections- lists, tuples, and dictionaries by performing insertion, deletion, traversal, and update operations, and demonstrate appropriate use cases and methods for each and Perform file handling operations: open, read, write, and append text files in python for persistent data storage.
4. Design and implement basic classes and objects in Python. Demonstrate inheritance and method overriding through a sample hierarchy and Write Python scripts to handle exceptions using try, except, and finally blocks. Demonstrate handling user-defined exceptions.
5. Design and build a small-scale Python project that demonstrates your understanding of core Python principles. Organize your code with modules, packages and sub packages
6. Implement Fractional Knapsack using greedy approach.
7. Implement Job scheduling with deadlines using greedy approach
8. Implement Longest common subsequence using dynamic programming
9. Implement n-queens problem using backtracking
10. Implement graph coloring problem using backtracking

TEXT BOOKS:

1. R.S. Salaria, "Programming in Python", Khanna Book Publishing Co., Delhi.
2. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 4th Edition, 2022.

SUGGESTED READING:

1. Jeeva Jose, "Taming Python by Programming", Revised Edition, Khanna Book Publishing Co., Delhi.

ONLINE RESOURCES:

1. https://docs.python.org/3/tutorial/index.html
2. https://realpython.com/
3. https://docs.python.org/3/tutorial/datastructures.html.
4. https://www.sqlitetutorial.net/sqlite-python/

PRACTICE AND CHALLENGES:

1. https://www.hackerrank.com/
2. https://exercism.org/
3. https://leetcode.com/

22ECC37

BASIC ELECTRONICS AND SENSORS LAB

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

PREREQUISITE: Students should have prior knowledge of Applied Physics and Semiconductor Physics.

COURSE OBJECTIVES: This course aims to

1. Learn about various electronic components and devices.
2. Study the transistor characteristics in different modes.
3. Familiarize to use customizable software and modular measurement hardware to create user-defined measurement systems.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Familiarize with basic electronic components, devices, and systems.
2. Formulate the research problems associate with Transistor or Op-amp circuits.
3. Examine the Interfacing of myRIO with various sensors/transducers, Motors.
4. Examine and Measure the problems encountered in Robotos or sensor related systems.
5. Justify the solutions related with transistorized circuits for real-time applications.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	1	1	1	3	1	3	2	-	`1	-
CO 2	3	3	3	3	1	2	1	3	1	3	3	1	1	1
CO 3	3	3	3	3	2	2	2	3	2	2	3	1	1	1
CO 4	1	2	3	3	3	2	3	3	2	3	2	1	-	-
CO 5	1	2	3	3	3	2	3	3	2	3	2	-	1	1

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Study of Semiconductor components, sensors, transducers.
2. Characteristics of Semiconductor Diodes.
3. CRO Applications
4. Half Wave Rectifier with and without filters.
5. Full Wave Rectifiers with and without filters
6. Voltage Regulator using Zener diode.
7. CB Input and Output Characteristics
8. FET Characteristics
9. Operational Amplifiers – Inverting Op-Amp, Adder.
10. Operational Amplifiers – Integrator, Differntiator.
11. Interfacing LDR/Photo Resistor and LED with myRIO (Intensity control of LED with respect to Illumination).
12. Interfacing LM35, Thermistor, and Buzzer with myRIO. (Temperature Thresholding Application)
13. Interfacing IR Range Finder with myRIO. (Obstacle detection and Ranging)
14. Interfacing Motor with Motor Adapter using myRIO. (Motor momentum control)
15. Interfacing Accelerometer and Inbuilt accelerometer with myRIO. (Vibration calculation in specific axis)
16. **Structured Enquiry:** Design a switching circuit using BJT and analyse its operation.

17. **Open ended Enquiry:** Design a LED running lights circuit for vehicles to avoid accidents in fog/rain condition.

Note: At least 12 experiments are to be performed.

SUGGESTED READING:

1. Paul B. Zbar, Albert P.Malvino, Michael A. Miller, "Basic Electronics, a Text- Lab Manual", 7th Edition, TMH, 1994.
2. PaulB. Zbar, "Industrial Electronics, aText- Lab Manual", 4th Edition, 2008.
3. Jeffrey Travis and Jim Kring, "LabVIEW for Everyone: Graphical Programming Made Easy and Fun", 3rd Edition, Prentice Hall, 2007.
4. Ed Doering, NI myRIO Project Essentials Guide, Feb. 2016.

22CSI01N

MOOCS / TRAINING / INTERNSHIP

Instruction	3 to 4 Weeks / 90 Hours
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	2

COURSE OBJECTIVES: This course aims to

1. Exposing the students to the industrial environment and technologies.
2. Provide possible opportunities to learn, make them to understand and sharpen them to the real time technical/ managerial skills required at the job.
3. Expose with the current technological developments relevant to program domain.
4. Understand Engineer's responsibilities and ethics.
5. Opportunity to interact with the people of industry/society to understand the real conditions.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Learn new technologies and solve real time projects.
2. Expose to the industrial environment problems and technologies
3. Gain knowledge on contemporary technologies industrial requirements.
4. Identify , Design and Develop solutions for real world problems
5. Communicate their ideas and learning experiences through reports and presentations.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	2	2	1	1	3	2	3	3	2	3
CO 2	2	2	2	1	1	2	2	1	3	2	3	3	2	3
CO 3	3	2	1	1	1	2	2	1	2	2	3	3	2	2
CO 4	2	3	3	3	1	2	1	-	3	3	3	3	2	3
CO 5	1	1	1	1	1	1	-	-	2	3	3	2	1	3

1 - Slightly, 2 - Moderately, 3 – Substantially

PROCESS TO BE FOLLOWED FOR CARRYING OUT INSTRUCTIONS TO STUDENTS:

1. Students may apply for internships through the AICTE Portal or through CDC of the institute by filling the application form IAP-101.
2. Industry shall scrutinize the students based on their criteria and communicate a provisional offer or confirmation letter to the student.
3. If students apply through CDC, then CDC shall nominate the students for various opportunities accordingly by issuing NOC (IAP-104).
4. The respective head of the department shall assign a faculty mentor.
5. Student shall undergo internship/industrial training at the concerned Industry/Organization by submitting the form, IAP-103.
6. During the internship, Faculty Mentor will evaluate the performance of students twice either by visiting the Industry/Organization or through obtaining periodic reports from students.
7. Student shall submit internship report to the industry/organization at the end of internship program.
8. On successful completion of the Internship, Industry/Organization shall issue Internship Certificate to the students
9. All the students should maintain discipline, professional ethics and follow the health and safety precautions during internship

Student shall maintain diary during the internship and submit the internship report at the end of the internship. The report will be evaluated by the supervisor on the basis of the following criteria:

- Originality
- Adequacy and purposeful write-up
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience
- Practical applications, relationships with basic theory and concepts taught in the course

Evaluation of Internship: The internship of the students will be evaluated in three stages:

1. Evaluation by the Industry (10 Marks)
2. Evaluation by faculty Mentor on the basis of site visit(s) or periodic communication (**15** marks)
3. Evaluation through seminar presentation/Viva-Voce at the Institute (This can be reflected through marks assigned by Faculty Mentor (**25 marks**)

For further details regarding templates, assessment guidelines please refer to the document from page number 16 onwards available at: https://www.cbit.ac.in/wp-content/uploads/2019/04/R22-Rules-with-internship-guidelines-10-11-2022..pdf.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT of COMPUTER SCIENCE AND ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION
(Inline with AICTE Model Curriculum with effect from AY 2025-26)
(R22A Regulation)

SEMESTER – IV

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22CSC10N	Computer Organization and Architecture	4	-	-	3	40	60	4
2.	22CSC11N	Database Management Systems	3	-	-	3	40	60	3
3.	22CSC48	Theory of Computation	3	-	-	3	40	60	3
4.	22CSC42	Web Programming	3	-	-	3	40	60	3
5.	22MTC12	Probability and Statistics	3	1	-	3	40	60	4
PRACTICAL									
6.	22CSC43	Web Programming Lab	-	-	3	3	50	50	1.5
7.	22CSC13N	Database Management Systems Lab	-	-	3	3	50	50	1.5
8.	22CSC09N	Latex Workshop	-	-	2	3	50	50	1
9.	22CSU01	Up Skill Certification Course-I	-			-	25	-	0.5
		TOTAL	**16**	**1**	**8**	**-**	**375**	**450**	**21.5**
Clock Hours Per Week: 25									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

22CSC10N

COMPUTER ORGANIZATION AND ARCHITECTURE

Instruction	4 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

PREREQUISITE: Digital Logic Design.

COURSE OBJECTIVES: This course aims to

1. Introduce principles of computer organization and basic architectural concepts.
2. It begins with the basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations.
3. Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and I/O systems, and multiprocessors

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the basics of instructions sets and their impact on processor design
2. Demonstrate an understanding of the design of the functional units of a digital computer system.
3. Evaluate cost performance and design trade-offs in designing and constructing a computer processor
4. Design a pipeline for consistent execution of instructions with minimum hazards
5. Understand how to perform computer arithmetic operations, pipeline procedures, and multiprocessors

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO 3	2	1	1	1	-	-	-	-	-	-	-	1	-	-
CO 4	1	1	1	1	-	-	-	-	-	-	-	1	-	-
CO 5	1	1	1	-	-	-	-	-	-	-	-	-	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT–I

Introduction to Computer Architecture: Introduction to Computer Architecture, basic computer operations, Performance Metrics (like Latency, throughput), Fundamental Blocks of Computer (like CPU, I/O subsystems, memory, control unit), Von-Neuman architecture, Harvard architecture, RISC and CISC.

UNIT–II

Instruction Set Architecture (ISA): Introduction to RTL, Registers, Arithmetic micro instructions, Logic micro instructions, shift micro instructions, Common bus system, Instruction Execution Cycle, Addressing Modes.

UNIT–III

Data Representation: Data Type Representation, fixed point representation, addition, subtraction, multiplication, Booth's algorithm, division restore algorithm, floating-point representation, Floating-point Addition/subtraction, Multiplication, Division.

UNIT–IV

Introduction to memory systems and Pipelining: SRAM Vs DRAM, cache memory, mapping, write policies, multi-level caching, virtual memory, Pipelining (Basics, Types, stalling, and forwarding), Throughput and Speedup of Pipelining, Pipelining Hazards

UNIT–V

Multiprocessors: Shared memory Vs Distributed memory systems, interconnection networks for multiprocessors, Bus-Based, Crossbar, Multi-stage, Hypercube, and Mesh Networks,

TEXT BOOKS:

1. J.L. Hennessy and D.A. Patterson, "Computer Architecture: A Quantitative Approach", 5th edition, Morgan Kauffmann Publishers, 2012.
2. M. Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Publication, 2017.

SUGGESTED READING:

1. Jon Stokes, "Inside the Machine: An Illustrated Introduction to Microprocessors and Computer Architecture", 1st Edition, No Starch Press, 2015.
2. Noam Nisan and Shimon Schocken, "The Elements of Computing Systems: Building a Modern Computer from First Principles", 2nd Edition, The MIT Press, 2021.
3. Car Hamacher, Zvonks Vranesic, Safea Zaky, "Computer Organization", 5th Edition, McGraw Hill, 2011.
4. William Stallings, "Computer Organization and Architecture", 6th Edition, Pearson/PHI, 2007.
5. Andrew S. Tanenbaum, "Structured Computer Organization", 6th Edition, PHI/Pearson, 2013.

ONLINE RESOURCES:

1. http://www.geeksforgeeks.org/computer-organization-and-architecture-gq/
2. https://www.cs.virginia.edu/c++programdesign/slides/pdf/bw01.pdf
3. ttps://www.tutorialspoint.com/computer_organization/index.asp
4. https://sites.google.com/site/uopcog/

22CSC11N

DATABASE MANAGEMENT SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Programming and Data Structures.

COURSE OBJECTIVES: This course aims to

1. Familiarize students with fundamental concepts of database management. These concepts include aspects of database design, database languages and database-system implementation.
2. Understand about data storage techniques and indexing.
3. Impart knowledge in transaction management, concurrency control techniques and recovery procedures.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand fundamental concepts of database and design database schema for an application.
2. Write relational algebra expression and SQL queries for various tasks.
3. Apply the principles of functional dependency and normalization to ensuredata integrity
4. Understand indexing and transaction processing
5. Analyze transaction processing, concurrency control and recovery mechanisms.

CO-PO ARTICULATION MATRIX

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	2	3	-	-	-	-	-	1	2	2	2
CO 2	2	3	2	2	3	-	-	-	-	-	1	2	2	2
CO 3	2	1	2	1	3	-	-	-	-	-	-	2	2	2
CO 4	2	1	1	-	-	-	-	-	-	-	-	2	2	2
CO 5	2	1	-	1	-	-	-	-	-	-	-	2	2	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators, Database System Architecture, Data Models, **E-R Model**: Introduction, Constraints, E-R Diagrams, E-R Design Issues, Mapping from ER to relational model, Extended E-R Features.

UNIT-II

Relational Algebra: Introduction to relational algebra operations, Basic relational algebra operators, Natural join, Assignment operator. **SQL:** Data Types, Basic Structure of SQL Queries, Modification of the Database, Set Operations, Aggregate Functions, Data-Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Simple Queries (select/project/join/ aggregate queries), Complex queries (With Clause, Nested Sub queries, Views)

UNIT-III

Functional Dependency: Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Attribute closure, Irreducible Set of Functional Dependencies, lossless decomposition, **Normalization**–1NF, 2NF, 3NF and BCNF, Dependency preserved decomposition, Comparison of BCNF and 3NF.

UNIT–IV

Indexing: Basic Concepts, Primary Index, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+Tree Index Files, Hash indices, Bitmap indices. **Transaction Processing:** Concept of transactions and schedules, ACID properties, Conflict-serializability

UNIT-V

Concurrency control: Lock-Based Protocols, Dead lock handling, Timestamp-Based Protocols, Validation-Based Protocols. **Recovery system:** Failure classification, Log based recovery, recovery algorithm, ARIES.

TEXT BOOKS:

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill, 2021.
2. C.J. Date, "An Introduction to Database Systems", 8th edition, Pearson, 2020,

SUGGESTED READING:

1. Raghu Ramakrishnan, JohnnesGehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2014.
2. Elmasri and Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Pubs, 2017.
3. Lemahieu, Broucke and Baesens, "Principles of Database Management", Cambridge University Press, 2018.
4. Krishnan, "Database Management Systems", McGraw Hill.

ONLINE RESOURCES:

1. http://www.nptelvideos.in/2012/11/database-managementsystem.html.

22CSC48

THEORY OF COMPUTATION

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Discrete Structures, Data Structures, Design and analysis of algorithms.

COURSE OBJECTIVES: This course aims to

1. Study abstract computing models namely Finite Automata, Pushdown Automata, and Turning Machines.
2. Introduce various grammars, formal languages and equivalence between various languages and their corresponding recognizers.
3. Familiarize with decidability and undecidability of computational problems.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Build Deterministic, Nondeterministic Finite automata for Languages and show the acceptance of strings using Formal Machines.
2. Develop regular expressions and their equivalent finite automata for various languages.
3. Demonstrate context-free grammar, check the ambiguity of grammar.
4. Construct pushdown automata for languages and Analyze Equivalence of PDA's, CFG's.
5. Design Turing Machines, Analyze and distinguish between decidable and undecidable problems.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	1	-	-	-	-	1	-	1	-	-
CO 2	2	1	1	-	1	-	-	-	-	-	-	1	-	-
CO 3	2	1	1	-	1	-	-	-	-	-	-	1	-	-
CO 4	2	1	1	-	1	-	-	-	-	-	-	2	-	-
CO 5	2	1	1	-	1	-	-	-	-	1	-	2	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Automata: Introduction to Finite Automata, the Central Concepts of Automata Theory: Alphabets, Strings and Languages. **Finite Automata:** Deterministic Finite Automata, Nondeterministic Finite Automata, Equivalence of NFA and DFA, Finite Automata with Epsilon -Transitions, Minimization of DFA, Introduction to Mealy and Moore machine, Equivalence of Mealy and Moore Machine.

UNIT-II

Regular Expression and languages: Regular Expressions, Finite Automata and Regular Expression: From DFAs to Regular Expressions, Converting Regular Expressions to Automata, Applications of Regular Expressions, Algebraic Laws for Regular Expressions. **Properties of Regular Languages:** The pumping lemma for Regular Languages, Applications of Pumping Lemma, Closure Properties of Regular Languages, Decision Properties of Regular Languages.

UNIT-III

Context Free Grammars and Languages: Context-Free Grammars, Leftmost and Rightmost Derivations, The language of a Grammar, Constructing Parse Trees, The Yield of a Parse Tree, Applications of CFGs, Ambiguous Grammars, Removing Ambiguity From Grammars. **Properties of Context Free Languages:** Normal Forms for Context-Free Grammars: Eliminating Useless Symbols,

Computing the Generating and Reachable Symbols, Eliminating Epsilon Productions, Eliminating Unit Productions, Chomsky Normal Form, Greibach Normal form, Pumping Lemma for CFL.

UNIT-IV

Pushdown Automata: The Formal Definition of PDA, Graphical Notation for PDA's, Instantaneous Description of a PDA, The Language of a PDA: Acceptance by Final State, Acceptance by Empty Stack, Equivalence of PDA's and CFG's: From Grammars to PDA's, From PDA's to Grammars, Deterministic Pushdown Automata. **Context-sensitive Languages**: Context-sensitive grammars (CSG), linear bounded automata.

UNIT-V

Introduction to Turing Machines: Notation for the TM, Instantaneous Descriptions for TM's, The Language of a TM, Turing Machines and Halting, Extensions to the Basic Turing machine, Restricted Turing machines, Turing Machines and computers. **Undecidability:** Codes for Turing Machines, The Diagonalization Language, The Universal Language, Undecidablity of the Universal Language, Undecidable problems about Turing Machines: Rice's Theorem and Properties of RE languages, Post's Correspondence Problem: Definition of PCP, The Modified PCP.

TEXT BOOKS:

1. John E. Hopcroft, Rajeev Motwani, Jeffery D Ullman, "Introduction to Automata Theory Languages and Computation", 3rd Edition, Pearson Education, 2015.

SUGGESTED READING:

1. John C Martin. "Introduction to Language and Theory of Computation", 3rd Edition, TMH, 2003.
2. Daniel Cohen, "Introduction to Computer Theory", 2nd Edition, Wiley Publications, 2007.
3. Mishra K., Chandrasekaran N., "Theory of Computer Science (Automata, Languages and Computation)", 3rd Edition, Prentice Hall of India 2008.
4. Shyamalendra Kandar, "Introduction to Automata Theory, Formal Languages and Computation", Pearson, 2013.

ONLINE RESOURCES:

1. http://courses.cs.vt.edu/cs4114/spring2012/index.php
2. http://online.stanford.edu/course/automata-theory
3. https://nptel.ac.in/courses/106103070
4. https://nptel.ac.in/courses/106106049

22CSC42

WEB PROGRAMMING

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to
1. Acquire knowledge on HTML, Java Script and XML to develop client side web applications.
2. Learn developing web applications using Vue.js.
3. Explore various features of JS and its functionality.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand the technologies required for developing web application.
2. Identify and choose HTML tags, CSS and java scripts to develop well-structured and easily maintained web pages.
3. Design and develop interactive and innovative web pages using various platforms/technologies like HTML, CSS, XML, JAVASCRIPT.
4. Create web applications using Vue.js framework.
5. Build an end-to-end application from scratch using Vue.js, Node.js and Mongo DB.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	1	1	-	-	1	1	1	-	1	1	-
CO 2	2	1	2	1	2	-	-	-	-	1	1	1	1	-
CO 3	1	1	2	1	2	-	-	-	-	-	-	1	-	2
CO 4	1	-	2	1	2	-	-	-	-	-	-	-	-	3
CO 5	1	-	2	2	1	-	-	-	-	-	1	1	-	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Web Basics: Introduction to Internet, World Wide Web, URL, MIME, HTTP Transactions, SSL, Client-Side Scripting, Server-Side Scripting, Accessing Web Servers, MySQL, IDEs.

UNIT-II

Introduction HTML5: basic tags, Images, Tables, Lists, Forms, Layout, Graphics, span and div tags, Introduction to Cascading Style Sheets. **XML:** Introduction, uses of XML, the Syntax of XML, XML Document Structure, Namespaces, XML schemas.

UNIT-III

The Basics of Java script: Primitive operations and Expressions, Arrays, Functions, Pattern Matching Using Regular Expressions, Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements, Introduction to JSON. **JQuery:** Introduction, Positioning Elements, Moving Elements.

UNIT-IV

Bootstrap: Introduction to Bootstrap, bootstrap grid, bootstrap components. **Vue.js:** Introduction, Instance and Template Syntax, Directives, Components and Props, Events, Event modifiers, Forms and Two-way Binding, Routing, Connecting Vue.js with databases.

UNIT-V

Node.js: Introduction, server creation. **MongoDB:** Introduction, Importance of NoSQL databases, Data types, Documents, nested Documents, CRUD Operations, Basic cursor methods: map, to Array, pretty, for Each, limit, count, sort, CRUD Operations.

TEXT BOOKS:

1. HTML5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery), Dreamtech, 2017.
2. Full stack Vue The Complete Guide to Vue.js, Hassan Djirdeh,2018.

SUGGESTED READING:

1. Simon D. Holmes and Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Second Edition, Manning Publications, 2019.
2. Edition, Manning Publications, 2019 JavaScript, by Alok Ranjan, Abhilasha Sinha, Ranjit Battwad, BPB, 2020.

ONLINE RESOURCES:

1. https://www.w3.org/standards/webdesign/
2. https://vuejs.org/examples/
3. https://www.mongodb.com/

22MTC12

PROBABILITY AND STATISTICS

Instruction	3 L + 1 T Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

COURSE OBJECTIVES: This course aims to

1. Learn and analyzing data in Linear and Non-Linear form.
2. Learn methods to solve bivariate probability functions.
3. Explain hypothetical data using probability distribution.
4. Discuss the testing of hypothesis of sample data.
5. Formulate and get the solution of real world problem.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Analyze the coefficient of skewness and fitting of the data by various methods.
2. Estimate the marginal probabilities of statistical averages.
3. Use the basic probability for fitting the Random phenomenon.
4. Apply various tests for testing the significance of sample data.
5. Analyze the random phenomena of real world data.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	-	-	-	-	-	-	2	2	1	-
CO 2	3	3	2	3	-	-	-	-	-	-	2	2	1	-
CO 3	3	3	2	3	-	-	-	-	-	-	2	2	1	-
CO 4	3	3	3	3	-	-	-	-	-	-	2	2	1	-
CO 5	3	3	2	3	-	-	-	-	-	-	2	2	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Basic Statistics: Measures of Central Tendency, Measures of Dispersion, Moments (Moments about the mean and moments about a point). Skewness, Karl Pearson's coefficient of skewness and Bowley's coefficient of skewness for frequency distribution, Kurtosis. Correlation, coefficient of correlation, limits of correlation coefficient. Linear Regression, Regression coefficients, Properties of Regression Coefficients. Curve fitting by the Method of Least Squares, Fitting of Straight lines and Exponential curve.

UNIT-II

Univariate and Bivariate Distribution. : Conditional Probability, Baye's theorem. Random variable, discrete random variable, Probability Mass Function, continuous random variable, probability density function. Mathematical expectation, properties of Expectation, properties of variance and co-variance. Two-dimensional or Joint Probability Mass Function, Two-dimensional Distribution Function, , Joint Density Function, Marginal Density Function, The Conditional Distribution Function, and Conditional Probability Density Function, Stochastic Independence.

UNIT-III

Probability Distributions: Discrete probability distribution: Poisson distribution, Mean, Variance, MGF, CGF, fitting of Poisson distribution. Continuous probability distributions: Normal distribution, Standard Normal random variable Expectation, Variance, MGF (without proof), CGF, Properties of

Normal Curve and Areas under Normal curve. Exponential distribution, Expectation, Variance, MGF, CGF.

UNIT-IV

Testing of Hypotheses: Test of significance, null and alternative hypotheses, Errors in sampling, level of significance. Large sample test: Test of significance for single proportion, difference of proportions, single mean and difference of means. Small Sample Tests: T-Test for single mean, differences of Means. F-Test for equality of two population variances. Chi-Square test of Goodness of fit.

UNIT-V

Analysis of Variance and Time Series: One way classification-Assumptions for ANOVA Test-ANOVA for fixed effect model-Two-way classification-ANOVA for fixed effect model-Components of Time series-Measurement of Trend- Method of semi Averages- Moving Averages Method (3 Years and 5 Years).

TEXT BOOKS:

1. S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

SUGGESTED READING:

1. W. Feller, "An Introduction to Probability Theory and its Applications", Vol. 1, 3rd Ed., Wiley, 1968.
2. S.C.Gupta, V.K.Kapoor, "Fundamentals of Applied Statistics", Sultan Chand and Sons, 2014.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/110/107/110107114/
2. https://archive.nptel.ac.in/courses/111/105/111105091/(week-6)
3. https://www.youtube.com/watch?v=YtLmLPI-7sE
4. https://www.youtube.com/watch?v=z7AE2kUoZYU&list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE&index=2
5. https://www.youtube.com/watch?v=EYRPpw2BI1s&list=PLp6ek2hDcoNCSeG01wrtcT9eE6S7YULtR

22CSC43

WEB PROGRAMMING LAB

Instruction	3 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to

1. Build Strong expertise to develop front end applications using HTML5 and CSS3.
2. Become proficient in Bootstrap concepts.
3. Understand core features of JavaScript.
4. Learn how to develop web applications using Vue.js.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Identify and install web development tools.
2. Build interactive and user-friendly static frontend UI applications using HTML, CSS and JavaScript.
3. Develop a web page based on Bootstrap.
4. Validate form data and create dynamic content using javascript.
5. Build an end-to-end application from scratch using Vue.js, Node.js and Mongo DB.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	3	1	1	-	-	1	1	1	2	1	1	-
CO 2	2	-	2	1	2	-	-	-	-	1	-	1	1	2
CO 3	2	-	1	1	2	-	-	-	-	-	2	1	1	3
CO 4	2	-	1	2	3	-	-	-	-	-	3	1	1	2
CO 5	2	-	2	2	1	-	-	-	-	-	-	1	1	3

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Creation of development environment (IDE, Web Server) and Demonstration of Web Browsers (Different components, Checking SSL Certificates, Inspect Elements, Browser Console, View Source etc.).
2. Design simple web pages using HTML5 and CSS.
3. Create well-formed document using XML schema. Apply CSS to style and format an XML document then display it in a browser
4. Develop an application to validate form fields using java script.
5. Demonstrate DOM manipulation using Jquery: dynamically change content and style of a page
6. Build a website using HTML5, CSS3, Bootstrap and Java script.
7. Create a Vue.js app with data binding and user input handling.
8. Implement Routing in Vue.js.
9. Demonstrate the CRUD operations on MongoDB.
10. Build a mini Vue.js CRUD app that connects to a backend (using Axios with a mock server or Flask API)

TEXT BOOKS:

1. HTML5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery). Dreamtech Press, 2017.
2. Djirdeh, H. (2018). Fullstack Vue: The Complete Guide to Vue.js.

SUGGESTED READING:

1. Holmes, S. D., & Harber, C. (2019). *Getting MEAN with Mongo, Express, Angular, and Node* (2nd ed.). Manning Publications.
2. Ranjan, A., Sinha, A., & Battwad, R. (2020). *JavaScript Modern Web Development*. BPB Publications, 2020.

ONLINE RESOURCES:

1. https://www.w3.org/standards/webdesign/
2. https://vuejs.org/examples/
3. https://www.mongodb.com/

22CSC13N

DATABASE MANAGEMENT SYSTEMS LAB

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to

1. Become familiar with the concepts of structured query language.
2. Understand about Programming Language / Structured Query Language (PL/SQL).
3. Learn database constraints, DCL, TCL and advanced SQL commands.
4. Familiarize with cursors, triggers, exceptions, procedures and functions in PL/SQL.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Outline the built-in functions of SQL and Create, Alter and Drop table.
2. Demonstrate Queries to retrieve and Change Data using Select, Insert, Delete and Update. Construct Queries using Group By, Order By and Having Clauses.
3. Demonstrate Commit, Rollback, save point commands and formulate the Queries for Creating Views and constraints.
4. Develop queries using Joins, Sub-Queries.
5. Develop PL/SQL code to create stored procedures, functions, cursors and exceptions.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	-	-	-	-	-	1	2	2	2
CO 2	3	2	2	2	3	-	-	-	-	-	1	2	2	2
CO 3	3	1	2	1	3	-	-	-	-	-	-	2	2	2
CO 4	3	-		2	-	-	-	-	-	-	-	2	2	2
CO 5	3	1	2	1	-	-	-	-	-	-	-	2	2	2

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Queries using Built-In functions, like aggregate functions, String Functions, Numeric Functions, Data Functions, Conversion Functions and other miscellaneous.
2. Queries using DDL and DML statements.
3. Queries using Group By, Order By, Having Clauses and set operations.
4. Queries on Controlling Data: Commit, Rollback and Save point.
5. Queries for Creating, Dropping and Altering Tables, Views and Constraints.
6. Queries using Joins, views and Sub-Queries.
7. Write PL/SQL code using Basic Variables, bind and substitution variables.
8. Write PL/SQL code using Control Structures.
9. Write PL/SQL code using Procedures, Functions.
10. Write PL/SQL code using Cursors, Triggers and Exceptions.

TEXT BOOKS:

1. "Oracle: The complete Reference", Oracle Press.
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007.

SUGGESTED READING:

1. Rick FVander Lans, "Introduction to SQL", 4th Edition, Pearson Education, 2007.
2. "The Language of SQL (Learning)" by Larry Rockoff.
3. Steven Feuerstein, "Oracle PL/SQL Programming", 6th Edition, O'reilly publications, 2014.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

22CSC09N

LATEX WORKSHOP

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

COURSE OBJECTIVES: This course aims to

1. Familiarize the students with documentation and visualization tools like LaTeX.
2. Develop proficiency in documentation for presentation and report writing.
3. Explore the utilities in LaTeX.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the need of documentation tools.
2. Install the documentation tools.
3. Generate templates for generation report using LaTeX
4. Generate templates for presentation reports using Beamer.
5. Explore the utilities of LaTeX. basics of electrical circuits with Nodal and Mesh analysis.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	2	1	-	-	-	-	-	1	-	1
CO 2	1	1	2	1	2	1	-	-	-	-	-	1	-	1
CO 3	2	3	3	2	3	1	-	-	1	-	-	2	-	1
CO 4	2	3	3	2	3	1	-	-	1	-	-	2	-	1
CO 5	1	1	2	1	2	1	-	-	1	-	-	1	-	1

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Exploring various environments and Installation of LaTeX.
2. Understanding LaTeX compilation, basic syntax.
3. Create a LaTeX document with various formatting styles.
4. Understand Page Layout –Titles, abstract, chapters, sections, references, equation, references, citation, table of contents, generating new commands.
5. Create a LaTeX document with following mathematical equations along with equation numbers in Italic format: Ex-summation (represent in sigma symbol), integration, integral of summation.
6. Create a LaTeX documents with images and image caption at centre alignment, table with thick border and table caption with centre alignment, row height, content with cell centre alignment.
7. Create a LaTeX document to write an algorithm using algpseudocode and algorithm packages. Use the lst listing package in LaTeX to write source code in any programming language.
8. Work on basic power point utilities and tools in LaTeX which help them create basic power point presentation. PPT Orientation, Slide Layouts, Inserting Text, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows Beamer, slides preparation.
9. Create a Resume, Lab Report, Article.
10. Create a technical report according to IEEE format includes title of the paper, authors name and affiliations, abstract and keywords, introduction section, background section, and other sections, references.

TEXT BOOKS:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education India,2005
2. LaTeX Companion – Leslie Lamport, PHI/Pearson,2004

ONLINE RESOURCES:

1. https://www.latex-project.org/help/documentation/
2. https://spoken-tutorial.org/tutorial ef,search?search_foss=LaTeX& search_language=English

22CSU01

UP SKILL CERTIFICATION COURSE-I

Instruction	-
Duration of SEE	-
SEE	-
CIE	25 Marks
Credits	0.5

The All India Council for Technical Education (AICTE) has established a comprehensive **Internship Policy** to enhance the employability and practical skills of students enrolled in technical education programs. This policy outlines the structure, objectives, and implementation guidelines for internships.

COURSE OBJECTIVES: This course aims to

1. Provide students with real-world industrial experience that complements academic learning.
2. Develop technical and managerial skills relevant to the student's field of study.
3. Foster professional attitudes, ethics, and communication skills.
4. Increase job readiness by bridging the gap between theoretical knowledge and practical application.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Apply academic knowledge and technical skills in a real-world industrial or organizational setting.
2. Demonstrate effective communication, teamwork, and problem-solving abilities in a professional environment.
3. Understand the structure, culture, and operational procedures of the Industry.
4. Develop and present professional reports and documentation based on internship experiences.
5. Exhibit on career goals and improve employability through hands-on experience and mentorship.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	3	2	2	1	1	2	2	1	2	3	2	3
CO 2	1	3	2	2	2	1	2	3	3	2	2	3	2	3
CO 3	2	1	1	1	2	2	2	2	2	1	2	3	2	2
CO 4	2	2	1	1	1	1	2	3	3	1	2	3	2	3
CO 5	1	2	2	1	2	2	2	2	2	1	3	2	1	3

1 - Slightly, 2 - Moderately, 3 – Substantially

Roles and Responsibilities:

- **Institutions**: Establish Training and Placement Cells to facilitate internship placements and maintain industry relations.
- **Students**: Proactively seek internship opportunities, maintain a daily logbook, and submit a comprehensive report upon completion.
- **Industry Partners**: Provide meaningful work assignments, mentorship, and evaluate student performance

Evaluation and Certification:

- **Assessment**: Student performance is evaluated based on reports, presentations, and feedback from industry mentors.
- **Certification**: Upon successful completion, students receive certificates from the host organization, which are considered during academic evaluations.

References:

1. **AICTE Internship Portal**: Students can explore and apply for internships through the AICTE Internship Portal. https://internship.aicte-india.org/

2. **AICTE Internship Policy Document**: Detailed guidelines and procedures can be found in the official. https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT of COMPUTER SCIENCE AND ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION
(Inline with AICTE Model Curriculum with effect from AY 2026-27)
(R22A Regulation)

SEMESTER - V

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22ITC10N	Computer Networks	3	-	-	3	40	60	3
2.	22CSC15N	Operating Systems	3	-	-	3	40	60	3
3.	22CSC21N	Software Engineering	3	-	-	3	40	60	3
4.	22CSC59	Fundamentals of Data Science	3	-	-	3	40	60	3
5.	22CSExx	Professional Elective Course-I	3	-	-	3	40	60	3
6.	22xxxxx	Open Elective Course – I	3	-	-	3	40	60	3
PRACTICAL									
7.	22ITC11N	Computer Networks Lab	-	-	3	3	50	50	1.5
8.	22CSC18N	Operating Systems Lab	-	-	3	3	50	50	1.5
9.	22CSC49	Software Engineering Lab	-	-	3	3	50	50	1
Total			**18**	**-**	**9**	**-**	**390**	**510**	**22**

L: Lecture **T: Tutorial** **P: Practical**
CIE: Continuous Internal Evaluation **SEE-Semester End Examination**

Professional Elective – I	
22CSE01	Computer Graphics and Multimedia
22CSE03N	Optimization Techniques
22CSE17	Mobile Application Development
22CSE19	Big Data Analytics
22CAE03N	Image Processing

Open Elective - I	
22BTO01	Biology For Engineers
22CEO02	Disaster Risk Reduction and Management
22CHO04	Environmental and Sustainable Development
22MEO01	Principles of Design Thinking
22ECO05	Principles of Embedded Systems

22ITC10N

COMPUTER NETWORKS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This Course aims to

1. Understand the basics of Layering Concepts, Physical layer, data transmission, transmission media.
2. Demonstrate the state-of-the-art knowledge on data link layer concepts.
3. Distinguish the different types of routing algorithms and network layer in the Internet.
4. Introduce Transport Layer basics, UDP and TCP Protocols.
5. Know the concepts of Application Layer Protocols.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Explain the functions of each layer in the OSI, TCP/IP reference models and demonstrate the concepts of Physical Layer.
2. Analyse the Data Link Layer protocols and MAC mechanisms.
3. Evaluate the Routing algorithms and the IP Protocols.
4. Illustrate the functions and performance of Internet Transport Protocols TCP and UDP.
5. Explore the various Application layer protocols.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	2	1	-	-	-	-	-	-	2	3	2
CO 2	3	3	3	2	1	-	-	-	-	-	-	3	3	2
CO 3	3	3	2	2	3	-	-	-	-	-	-	3	3	2
CO 4	3	3	2	2	2	-	-	-	-	-	-	3	3	3
CO 5	2	2	1	2	3	3	3	2	3	3	3	3	3	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction: Network Hardware, Network Topologies, Reference Models- The OSI Reference Model- the TCP/IP Reference Model – A Comparison of the OSI and TCP/IP Reference, Packet Switching, Circuit Switching and Virtual Circuit Switching. Physical Layer: Guided Transmission media, Twisted Pairs, Coaxial Cable, Fiber Optics, Wireless transmission.

UNIT-II

Data Link Layer: Design Issues, Error Detection and Correction, Elementary Data Link Protocols: Simplex Protocol, A Simplex Stop and Wait Protocol for an Error-free channel, Sliding Window Protocols, Go-Back-N, Selective Repeat. Medium Access Sub Layer: The Channel allocation problem, Multiple Access Protocols: ALOHA, Carrier Sense Multiple Access Protocols.

UNIT- III

Network Layer: Design Issues, Routing algorithms: The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, OSPF, BGP, Quality of Service, The Network layer in the Internet- The IP Version 4 Protocol, IP Addresses, IP Version 6.

UNIT-IV

Transport Layer: Transport Service, Berkeley Sockets, Elements of Transport Protocols, **The Internet Transport Protocols:** Introduction to UDP, The TCP Protocol, The TCP Segment Header, The TCP Connection Establishment, TCP Connection Release, TCP Sliding Window, TCP Timer

Management, TCP Flow Control, Congestion Control.

UNIT-V

Application Layer: DNS, The Domain Name System, The DNS Name Space, Domain Resource Records, Name Servers. **Electronic MAIL:** Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, SMTP, FTP, TELNET, SNMP.

TEXT BOOKS:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2014.

SUGGESTED READING:

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson Education, 2021.
2. Chwan-Hwa (John) Wu, J. David Irwin, "Introduction to Computer Networks and Cyber Security", CRC Press, 2013.
3. W. Richard Stevens, "Unix Network Programming", Prentice Hall/Pearson Education, 2009.
4. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 5th Edition, Addison-Wesley, 2012.
5. Larry L. Peterson and Bruce S. Davie "Computer Networks: A Systems Approach", 5e, 2018
6. Behrouz A. Forouzan "Data Communications and Networking", Fourth Edition,2007.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/117105148,title of the course
2. Computer Networks - Books, Notes, Tests 2025-2026 Syllabus
3. IEEE Transactions on Networking | IEEE Communications Society
4. Web Resources for Computer Networks, 5 (vu.nl)

22CSC15N

OPERATING SYSTEMS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Computer Architecture and Programming Fundamentals.

COURSE OBJECTIVES: This course aims to

1. Understand the basic concepts and design of an operating system.
2. Interpret the structure and organization of the file system.
3. Learn Inter Process Communication mechanisms and memory management approaches.
4. Explore cloud infrastructures and technologies.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the basics of Operating systems and its major components.
2. Illustrate the concepts related to process management.
3. Distinguish various memory management techniques.
4. Apply concepts of process synchronization and deadlocks to a given situation.
5. Evaluate various file allocation methods and security as well as recovery features in the designing Operating system.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	-	-	-	-	-	-	-	2	1	1
CO 2	3	3	-	3	1	-	-	-	-	-	-	2	2	2
CO 3	3	3	2	1	1	-	-	-	-	-	-	2	2	2
CO 4	3	3	1	3	-	-	-	-	-	-	-	2	2	2
CO 5	3	3	2	3	1	-	-	-	-	-	-	2	2	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to Operating Systems: Computer System overview, Components of a computer system, functions of OS, Examples and different types of OS *(RTOS vs. desktop vs. mobile etc.),* OS distributions and versions. **OS architectures:** Micro-kernel, Layered, Kernel Approaches and examples, Linux/Unix OS Design and architecture overview.

UNIT-II

Process management: Program vs. process, process states, Process Control Block (PCB), OS services and system calls *(fork, wait, exec, getpid, getppid etc.),* system calls vs. System programs, Process scheduling- Process context switching, scheduling algorithms, scheduling criteria. Process management in Unix/Linux. **Inter Process Communication:** Linux IPC Mechanisms, RPC, RPC exception handling and Security issues.

UNIT-III

Memory Management: Memory view of a process, Process memory usage requirements, virtual and physical memory related system calls *(mmap, munmap, sbrk, mprotect).* Address translation mechanisms static mapping, segmentation, paging, page faults, page replacement algorithms, page sharing, read/write permissions, swapping. Memory management in Linux/Unix. **Secondary Memory Management:** Disk structure, disk scheduling, disk management, buffering, swap space management.

UNIT-IV

Concurrency and Synchronization: Introduction to threads, benefits, types and thread APIs, Synchronization, issues, hardware and software solutions for synchronization, Classical problems of synchronization. **Deadlocks:** Introduction, necessary conditions for deadlock occurrence, RAG, deadlock handling mechanisms - prevention, avoidance and recovery.

UNIT-V

File Systems: File concepts, file types, allocation and organization methods, file handling system calls, File system metadata, directory structure, caching optimizations, File Systems case study. **OS Security and Defence:** Types of threats in OS, basic security mechanisms, malware taxonomy, viruses, worms, and rootkits, logging, auditing, and recovery.

TEXT BOOKS:

1. Galvin, Silberschatz, "Operating system Concepts", 10th Edition, John Wiley & Sons, 2018.
2. William Stallings, "Operating Systems Internals and Design Principles" Pearson Edition, 2012.

SUGGESTED READING:

1. Ekta Walia Khanna, "Operating System Concepts", 2nd Edition, Publishing House, 2019.
2. W. Richard Stevens, Stephen A. Rago, "Advanced Programming in the UNIX® Environment", 3rd Edition, Pearson Education India; 2013.
3. Maurice J. Bach, "Design of the UNIX Operating System", 1st Edition, Pearson Education India, 2015.

ONLINE RESOURCES:

1. Remzi H. Arpaci-Dusseau and Andrea C. , "Three Easy Pieces", Arpaci-Dusseau Arpaci-Dusseau Books, LLC https://pages.cs.wisc.edu/~remzi/OSTEP/ (online version).
2. Frans Kaashoek, Robert Morris, and Russ Cox, Xv6, a simple Unix-like teaching operating system [T4-R] https://github.com/mit-pdos/xv6-riscv (RISC-V version) [T4-X] https://github.com/mit-pdos/xv6-public (x86 version).

22CSC21N

SOFTWARE ENGINEERING

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Object-oriented programming, Programming for problem-solving, database management systems.

COURSE OBJECTIVES: This course aims to

1. Understand the Software Engineering Practice and Process Models.
2. Understand Design Engineering and Project Management in Software Development.
3. Understand the importance of testing in software development and study various testing strategies and software quality metrics.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Acquire a working knowledge of software processes and models for each phase of software development.
2. Understand the agile Software process models and demonstrate the skills necessary to specify the requirements.
3. Recall the modelling concepts and estimate the cost of software using empirical models.
4. Enlist the design principles and construct a product using coding principles and standards.
5. Develop test cases and acquire skills necessary for independently developing a complete software project and estimate software quality.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	3	3	-	3	3	1	3	1	-	3
CO 2	3	2	3	1	-	2	-	3	3	1	3	1	-	3
CO 3	2	3	3	3	3	1	-	3	3	3	3	1	-	3
CO 4	3	3	3	2	3	2	-	3	3	2	3	1	-	3
CO 5	3	3	1	2	2	1	-	3	3	2	-	1	-	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Introduction to Software Engineering: Software Engineering Practice, The Software Process, Software Engineering Practice Process Models: A Generic Process Model, Process assessment and Improvement, Prescriptive Process Models: Waterfall Model, Incremental Process Models, RAD Model, Evolutionary Process Models - Prototyping, The Spiral Model, Specialized Process Models.

UNIT - II

An Agile Development: Agility, Agile Process, and Agile Process Models- Extreme Programming (XP), Adaptive Software Development (ASD), Scrum, Dynamic Systems Development Method (DSDM), Feature Driven Development (FDD), Agile Modelling (AM), Requirement Engineering, Establishing the groundwork, Eliciting Requirements, Negotiating Requirements, and Validating Requirements. Software Requirements Analysis and Specification: Value of a Good SRS, Problem Analysis, Requirements Specification.

UNIT - III

Planning a software Project: Effort Estimation, Project Schedule and Staffing, Quality Planning, Risk Management, Estimation for Software Projects: Decomposition Techniques - Software Sizing, Problem-Based Estimation, An Example of LOC-Based Estimation, An Example of FP-Based Estimation, COCOMO Model

UNIT - IV

Function-oriented modelling, Design Concepts -Coupling, Cohesion, Flow-oriented modelling-DFDs with Examples, Software Architecture, A Brief Taxonomy of Architectural Styles, Component-Level Design: Definition, Basic Design Principles, Design Guidelines, Designing Traditional Components, Coding Principles and guidelines, Incremental Development of Code, Code Inspection – Planning.

UNIT - V

Testing - Testing Concepts, Testing Process, Testing Strategies: A Strategic approach to software testing, strategic issues, test strategies for Conventional Software, Validation Testing, System Testing, White Box Testing, Black Box. Automatic vs. Manual Testing, Software Review Techniques - Informal Reviews Formal Technical Reviews, Quality Concepts - What is Quality, Software Quality, Objectives, Software Quality Attributes (McCall's,HP)Deployment overview, Deployment planning, Deployment Rollback.

TEXT BOOKS:

1. Roger S. Pressman "Software Engineering: A practitioner's approach", McGraw Hill, 8th Edition, 2014.
2. Pankaj Jalote, "Software Engineering Precise Approach", Wiley Publishers, 2012

SUGGESTED READING:

1. Sommerville "Software Engineering", 10th Edition, Pearson, 2016.
2. Rajib Mal "Fundamental of Software Engineering", 4th Edition, PHI Learning, 2014.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106101061/
2. Udemy:https://www.udemy.com/share/101BHy3@YYJn8BxwvS6cGfnCsiIlxyA-lUjwZmA2xN5WmMbd8hlGxwhc4N0DF7KaEOaz4eDnMg==/

22CSC59

FUNDAMENTALS OF DATA SCIENCE

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Understanding the fundamental concepts and scope of Data Science.
2. Develop a strong foundation in statistical methods and data analytics techniques.
3. Understanding data manipulation and analysis using Python libraries.
4. Understanding data preprocessing techniques.
5. Familiarize with supervised and unsupervised machine learning techniques.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the fundamental concepts of Data Science and its interdisciplinary nature, including its relationship with statistics.
2. Apply statistical and analytical techniques such as descriptive, diagnostic, predictive, and prescriptive analytics.
3. Implement data manipulation and analysis tasks using NumPy and pandas.
4. Analyze and clean real-world datasets using various preprocessing, filtering, encoding, and hypothesis testing techniques.
5. Develop and evaluate machine learning models for regression and clustering tasks using supervised and unsupervised learning techniques.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	3	3	-	1	-	-	-	2	3	3	3
CO 2	3	3	2	3	2	-	1	-	2	-	2	3	3	3
CO 3	3	3	3	3	3	-	1	-	1	-	2	3	3	2
CO 4	3	3	3	3	3	2	1	1	-	-	2	3	3	2
CO 5	3	3	3	3	3	2	1	-	-	-	3	3	3	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT–I

Introduction: What Is Data Science? Where Do We See Data Science? Finance, Public Policy, Politics, Healthcare, Urban Planning, Education, Libraries. How Does Data Science Relate to Other Fields: Data Science and Statistics, Data Science and Computer Science, Data Science and Engineering, Data Science and Business Analytics, Data Science, Social Science, and Computational Social Science, The Relationship between Data Science and Information Science: Information vs. Data Users in Information Science, Data Science in Information Schools (iSchools). Computational Thinking. Skills for Data Science, Tools for Data Science, Issues of Ethics, Bias, and Privacy in Data Science. **Data:** Introduction, Data Types: Structured Data, Unstructured Data, Challenges with Unstructured Data. **Data Collections:** Open Data, Social Media Data, Multimodal Data, Data Storage and Presentation. Data **Pre-processing:** Data Cleaning, Data Integration, Data Transformation, Data Reduction, Data Discretization.

UNIT– II

Techniques: Introduction: Data Analysis and Data Analytics, Descriptive Analysis: Variables, Frequency Distribution, Measures of Centrality, Dispersion of a Distribution. **Diagnostic Analytics:** Correlations, Predictive Analytics, Prescriptive Analytics, Exploratory Analysis, Mechanistic Analysis: Regression. **Statistics:** Understanding attributes and their types, Types of attributes, Discrete and continuous attributes, measuring central tendency: Mean, Mode, Median, measuring dispersion,

Skewness and kurtosis, understanding relationships using covariance and correlation coefficients: Pearson's correlation coefficient, Spearman's rank correlation coefficient, collecting samples, performing parametric tests. **Descriptive Statistics:** Understanding statistics, distribution functions uniform distribution, normal distribution, exponential distribution, binomial distribution. Cumulative distribution function, descriptive statistics.

UNIT–III

NumPy and pandas: Understanding NumPy arrays, NumPy array numerical data types, manipulating array shapes, The stacking of NumPy arrays, Partitioning NumPy arrays, Changing the data type of NumPy arrays, Creating NumPy views and copies, Slicing NumPy arrays, Boolean and fancy indexing, Broadcasting arrays, Creating pandas Data Frames, understanding pandas Series, Reading and querying the Quandl data, describing pandas Data Frames, Grouping and joining pandas Data Frame, working with missing values, creating pivot tables, dealing with dates.

UNIT–IV

Data Cleaning: Exploring data, Filtering data to weed out the noise, Column-wise filtration, row-wise filtration. Handling missing values, dropping missing values, Filling in a missing value, Handling outliers, Feature encoding techniques: one-hot encoding, Label encoding, ordinal encoder. **Correlation:** Introducing correlation, Types of analysis, understanding univariate analysis, understanding bivariate analysis, Understanding multivariate analysis. Discussing multivariate analysis using the Titanic dataset. **Hypothesis Testing and Regression:** Hypothesis testing, Hypothesis testing principle, stats models library, Average reading time, Types of hypothesis testing, T-test.

UNIT–V

Supervised Learning - Regression Analysis, Linear regression, Multiple linear regression, understanding multicollinearity, removing multicollinearity, Dummy variables, developing a linear regression model, Evaluating regression model performance, R-squared, MSE, MAE, RMSE, fitting polynomial regression, Regression models for classification, Logistic regression, Characteristics of the logistic regression model, Types of logistic regression algorithms, Advantages and disadvantages of logistic regression, implementing logistic regression using scikit-learn. **Unsupervised Learning clustering** - PCA and Clustering: Unsupervised learning, reducing the dimensionality of data, PCA, Performing PCA. Finding the number of clusters, the elbow method, the silhouette method, Partitioning data using k-means clustering, Hierarchical clustering, DBSCAN clustering, Spectral Clustering: clustering, Evaluating clustering performance, Internal performance evaluation, The Davies-Bouldin index, The silhouette coefficient, External performance evaluation, The Rand score, The Jaccard score, F-Measure or F1-score, The Fowlkes-Mallows score.

TEXT BOOKS:

1. Chirag Shah, "A Hands-On Introduction to Data Science", Cambridge University Press, 2020, 978-1108472449.
2. Avinash Navlani, Armando Fandango, and Ivan Idris, "Python Data Analysis: Perform Data Collection, Data Processing, Wrangling, Visualization, and Model Building Using Python", 3rd ed. Packt Publishing, 2021.

SUGGESTED READING:

1. Suresh Kumar Mukhiya and Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106106212
2. https://onlinecourses.nptel.ac.in/noc25_cs101

22CSE01

COMPUTER GRAPHICS AND MULTIMEDIA

(Professional Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Basic knowledge of Mathematics.

COURSE OBJECTIVES: This course aims to

1. Familiarize the students with fundamental algorithms that are used in interactive graphics systems.
2. Learn algorithms and techniques of fundamental 3D computer graphics and understand the relationship between the 2D and 3D versions of such algorithms.
3. Apply these algorithms and techniques in upcoming real world scenarios.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Illustrate the algorithm for drawing 2D Primitives.
2. Implement 2D transformations for an object.
3. Identify the visible and invisible surfaces of 3D objects by using surface detection algorithm.
4. Summarize various compression techniques and colour models in multimedia.
5. Develop animation for graphics design problems

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO 2	3	3	3	2	2	-	-	-	-	-	-	-	-	-
CO 3	3	3	3	2	3	-	-	-	-	-	-	-	-	-
CO 4	2	2	2	2	3	-	-	-	2	-	-	-	-	-
CO 5	3	2	2	2	3	-	-	1	2	1	-	-	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

2D Primitives: Graphics systems, Algorithms for drawing 2D primitives-Line, Circle and Ellipse, Attributes of Output primitives, Applications of computer graphics.

UNIT - II

2D Graphics: Two Dimensional Geometric Transformations, 2D Viewing, 2D Line Clipping, 2D Graphics design software-Inkscape, GIMP, Software.

UNIT - III

3D Graphics: 3D concepts, Object representations, 3D geometric and modeling transformations, 3D Viewing, Visible Surface detection methods.

UNIT - IV

Multimedia: Multimedia Objects, Graphics and image data representations, Color Models, Compression techniques and standards, Storage and Retrieval technologies, Hypermedia.

UNIT - V

Animation: Animation and Modeling techniques in multimedia, Texture and Shading, Tweening and Morphing, Lightening and Rendering, Image editing and Manipulation, Interactive animation using authorized tools-Blender, Synfig, Adobe Animate.

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, “Computer Graphics”, Pearson Education, 2014.
2. Andleigh, P. K and Kiran Thakrar, “Multimedia Systems and Design”, PHI, 1st Edition 2015.

SUGGESTED READING:

1. Judith Jeffcoate, “Multimedia in practice: Technology and Applications”, PHI, 2006.
2. J. D. Foley, A. van Dam, S. K. Feiner, and J. F. Hughes, "Computer Graphics: Principles and Practice," 2nd ed., Addison-Wesley, 2013.
3. J. McConnell, "Computer Graphics: Theory into Practice," Jones and Bartlett Publishers, 2006.
4. W. M. Newman and R. F. Sproull, "Principles of Interactive Computer Graphics," McGraw-Hill, 2001.

22CSE03N

OPTIMIZATION TECHNIQUES
(Professional Elective - I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Mathematical Foundation for Data Science and Security.

COURSE OBJECTIVES: This course aims to
1. Identify and develop optimization techniques from the verbal description of real system.
2. Learn different techniques to get optimum solution for a given LPP.
3. Understand the Mathematical representations that are needed to solve the problems.
4. Analyze the results of the different real-world problems.
5. Construct network and find critical path using network scheduling technique

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Identify the optimum values for given objective function of LPP using Graphical and Simplex approaches.
2. Solve the transportation problem using uv and steppingstone methods for maximize the profit with minimum resources
3. Determine the optimum feasible solution for assignment and travelling salesman problems and computing the optimal solution for Job sequencing models.
4. Compute the optimum values for given objective function by IPP and optimal strategy for games.
5. Construct a network diagram and identify critical path using network scheduling by CPM/PERT.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	-	1	-	-	-	-	-	-	-	1	-	-
CO 2	2	2	-	1	-	-	-	-	-	-	1	1	-	-
CO 3	2	2	1	1	-	-	-	-	-	-	1	1	-	-
CO 4	2	2	1	1	-	-	-	-	-	-	-	1	-	-
CO 5	2	2	-	1	-	-	-	-	-	-	1	1	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Introduction: Basics definitions, objectives, models, applications. **Linear Programming (LP)**: Mathematical Formulation of LP Problem (LPP), Graphical Method, Some Exceptional Cases, **Simplex Method**: Introduction, computational procedure, artificial variables technique, Big M Method.

UNIT - II

Duality Theory: Concept of duality, duality and simplex method, Transportation problem Introduction, Mathematical Formulation of transportation Problem, Balanced / Unbalanced, Minimization / Maximization, Determination of the initial basic feasible solution using (i) North-West Corner Rule (ii) Least cost method & (iii) Vogel's approximation method for balanced & unbalanced transportation problems. Obtaining of optimal solution using uv method and Steppingstone method.

UNIT - III

Assignment Routing Problems: Introduction, Mathematical Formulation of Assignment Problem, Hungarian method for optimal solution, solving unbalanced problem, Traveling salesman problem. **Sequencing Problems:** Sequencing models, Solution of Sequencing Problem – Processing n Jobs through 2 Persons/Machines – Processing n Jobs through 3 Persons/Machines – Processing 2 Jobs through m Persons /machines – Processing n Jobs through m Persons /Machines.

UNIT - IV

Game and strategies: Introduction, Game with maximin-minimax principle (Pure Strategies).Game with Mixed Strategies, Dominance Property, Linear Programming Approach for Game Theory. **Dynamic Programming:** Characteristics, DPP Algorithm, Solving LPP by dynamic programming.

UNIT - V

Network Analysis: Construction of Network Rules & Precautions, C.P.M. & P.E.R.T. Networks, Obtaining of Critical Path, Time estimates for activities, Probability of completion of project, Determination of floats. **Integer Programming Problem:** Introduction, Types of Integer Programming Problems, Gomory's All-IPP Method, All IPP Algorithm, Branch and Bound Technique.

TEXT BOOKS:

1. Kanti Swarup, P. K. Gupta, Man Mohan, "Operations Research", Sultan Chand Publications, 20th Revised Edition.
2. R. Pannerselvam, "Operations Research", PHI, 2nd Edition, 2016.

SUGGESTED READING:

1. Dr S P Gupta, Dr P K Gupta, 'Quantitative Techniques and Operations Research', Sultan Chand & Sons, 2022
2. Deb K. "Optimization for Engineering Design Algorithms and Examples", PHI, 2000.
3. Saravanan R. "Manufacturing Optimization through Intelligent Techniques", Taylor & Francis (CRC Press), 2006.
4. Hardley G. "Linear Programming", Narosa Book Distributors Private Ltd., 2002.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/111105039
2. https://nptel.ac.in/courses/105108127

22CSE17

MOBILE APPLICATION DEVELOPMENT

(Professional Elective – I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: OOPs concepts, Programming language skills.

COURSE OBJECTIVES: This course aims to

1. Introduce Kotlin, Flutter, and Dot Programming for efficient and scalable mobile application development.
2. Demonstrate the development of cross-platform mobile applications using Android (XML) and Flutter (Widgets), along with efficient coding practices using Dot Programming.
3. Implement multimedia, location-based services, and database management in Android applications, and deploy them on Google Play Store.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the fundamentals of Kotlin, Dot Programming, and Flutter for mobile application development..
2. Design user interfaces for Android applications using XML layouts and Flutter Widgets.
3. Implement efficient application logic using Intents, Broadcast Receivers, and Dot Programming techniques in Android.
4. Use multimedia, camera and Location based services in Android App.
5. Design and manage databases for Android applications using SQLite and SharedPreferences, and publish apps on Google Play Store..

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	2	2	-	-	-	-	-	1	2	1	-	-
CO 2	2	3	3	2	3	3	3	-	-	1	2	2	2	3
CO 3	2	2	3	3	2	3	3	-	-	1	2	2	2	3
CO 4	2	2	3	2	2	3	3	-	-	1	2	2	2	3
CO 5	2	2	3	3	3	3	3	-	-	1	2	2	2	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to Kotlin - Basic expressions - Control flow statements - null safety – Functions- passing functions as arguments - simple lambdas. Object oriented programming in Kotlin - Classes and Objects – Constructors - Visibility modifiers - Subclasses and Inheritance – Interfaces - Data classes - Singleton class – Pairs- Triples.

UNIT-II

Introduction to Android Architecture: History - Features and Android Architecture – Android SDK Tools - Application Components - User Interface Design - Views - View Groups – Layouts - Event Handling – Listeners – Adapters – Menus - Action Bars – Android Localization.

UNIT-III

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS. Broadcast Receivers – Using Intent filters to service implicit Intents,

Resolving Intent filters, finding and using Intents received within an Activity. Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT-IV

Camera –Playing audio/video - Media recording - Sensors - Listening to sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager, working with Google Maps extensions - Maps via intent - Location based Services - Location Updates - Location Providers - Selecting a Location Provider - Finding Location.

UNIT-V

Content Providers – Uri - CRUD access –Browser – CallLog – Contacts – Media Store - Data Access and Storage - Shared Preferences - Storage External - Network Connection - SQLite Databases - Deploying Android Application to the World.

TEXT BOOKS:

1. RetoMeier, "ProfessionalAndroid4Development", JohnWileyandSons, 2012.
2. Dawn Griffiths and David Griffiths, "Head First Android Development",1st Edition, O'Reilly SPD Publishers, 2015.

SUGGESTED READING:

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox,2012
2. Wei-engLee, BeginningAndroid4ApplicationDevelopment, 4thEdition, Wiley India (Wrox), 2013.
3. Beginning Flutter: A Hands on Guide to App Development 1st Edition by Marco L. Napoli, Wrox Professional guides,2019.
4. Dot Net Framework Made Easy: A Beginners Handbook To Easily Learn Dot Net Framework. (Code Dot Net Framework Easily) By Magige Robi, 2021.

ONLINE RESOURCES:

1. https://developer.android.com
2. http://www.androidcentral.com/apps
3. https://www.opensesame.com/c/android-app-development-beginners-training-course

22CSE19

BIG DATA ANALYTICS
(Professional Elective-I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Proficiency in python programming, Database fundamentals

COURSE OBJECTIVES: This course aims to
1. Introduce the importance of Big Data and the role of the Hadoop framework in analyzing large datasets.
2. Gain practical knowledge in working with Hadoop ecosystem tools such as MapReduce,pig, hive, Spark.
3. Provide hands-on experience in using Spark for real-time stream processing.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Define and describe the types, characteristics, and challenges of Big Data and the need for its analysis.
2. Analyze the differences between traditional systems and Hadoop and explain the functions of core components like HDFS and YARN.
3. Develop MapReduce programs and analyze different join strategies and pipeline models for big data processing.
4. Design and execute queries using Hive and Pig to extract, transform, and analyze large datasets.
5. Implement scalable data processing applications using Apache Spark and evaluate its performance over traditional frameworks

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	3	1	3	3	3	-	3	3	2	3	2	2	-
CO 2	3	3	3	3	3	2	-	3	3	2	3	2	2	2
CO 3	3	3	3	3	3	2	-	3	3	2	3	2	2	2
CO 4	3	3	3	3	3	2	-	3	3	2	3	1	2	3
CO 5	3	3	3	3	3	3	-	3	3	2	3	2	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to Big Data: Data and its types: Unstructured, Semi-structured, Structured – Sources of data – Evolution and Definition of Big Data – Characteristics(3Vs/5Vs) and Challenges – Need for Big Data, , Big data integration process, Applications.Overview of Business Intelligence, Data Science, Analytics – Typical analytical architecture – Types of Analytics (Descriptive, Predictive, Prescriptive)

UNIT-II

Hadoop Ecosystem: Requirement of Hadoop Framework - Design principle of Hadoop –Comparison with other system (SQL, RDBMS) - Core ccomponents of Hadoop – Architecture -Hadoop 1 vs Hadoop 2 – HDFS operations, Data ingestion layer, ETL and ELT, Ingestion tools in Hadoop ecosystem, Data ingestion types.

UNIT-III

Big Data Frame Works: Hadoop Framework: Introduction to MapReduce, Processing data with Hadoop using MapReduce, Map Reduce Programming: I/O formats, Map side join-Reduce Side Join,

Secondary Sorting-Pipelining MapReduce jobs. Introduction to YARN, Architecture, Managing Resources and Applications with Hadoop YARN.

UNIT-IV

Hive and Pig: Introduction to Hive: What is Hive, Hive Architecture, Hive data types, Hive file formats, Hive Query Language (HQL), RC File implementation, User Defined Function (UDF).
Introduction to Pig: What is Pig, Anatomy of Pig, Pig on Hadoop, Data types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User Defined Function, Pig Vs Hive.

UNIT-V

Apache Spark Framework: Introduction to Apache spark-Design principles, Advantages and Disadvantages, Layered architecture, Programming with RDDs: Create RDD- Spark operations - transformations, actions-DAG in Apache spark.
Case Study: Analyze student academic data to find trends, subject difficulty levels, and top performers using big data tools.

TEXT BOOKS:

1. S. Chandramouli, 'Big Data Analytics', University press,2024 edition.
2. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley India Pvt. Ltd., 2016.

SUGGESTED READING:

1. Tom White, 'Hadoop: The Definitive Guide', 4th Edition, O'Reilly Media Inc, 2015.
2. Thilinagunarathne, 'Hadoop MapReduce v2 Cookbook', 2nd Edition, Packet Publishing, 2015.
3. Chuck Lam, Mark Davis, Ajit Gaddam, 'Hadoop in Action', Manning Publications, 2016.
4. Alan Gates, 'Programming Pig', O'Reilly Media Inc, 2011.

ONLINE RESOURCES:

1. http://www.planetcassandra.org/what-is-nosql
2. http://www.iitr.ac.in/media/facspace/patelfec/16Bit/index.html
3. https://class.coursera.org/datasci-001/lecture
4. http://bigdatauniversity.com

22CAE03N

IMAGE PROCESSING
(Professional Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Signal Processing

COURSE OBJECTIVES: This course aims to
1. Introduce basics of visual perception, sampling, quantization and representation of Digital images.
2. Introduce spatial domain and frequency domain filtering techniques necessary for Image processing operations.
3. Learn advanced image analysis techniques such as image restoration, image Compression, image segmentation.
4. Learn techniques of multi resolution methods, wavelets and morphological Processing.
5. Understand the applications of image processing.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand the basic image enhancement techniques in spatial & frequency domains.
2. Understand the basics of multi-resolution techniques.
3. Understand the basics of segmentation methods.
4. Apply this concept for image handling in various fields.
5. Knowledge about Morphological operations

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	2	3	1	1	1	1	1	1			
CO 2	3	2	2	2	3	1	1	1	1	1	1			
CO 3	3	2	2	2	3	1	1	1	1	1	1			
CO 4	3	2	3	3	3	2	1	1	2	2	2			
CO 5	3	2	2	2	3	1	1	1	1	1	1			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Fundamentals of Image Processing: Introduction, , fundamental steps, components, , , image sensing and acquisition, image sampling and quantization, basic relationships between pixels. Intensity Transformations and Spatial Filtering: Background, some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods.

UNIT-II

Filtering in the Frequency Domain: Background, preliminary concepts, sampling and Fourier transform of sampled functions, discrete Fourier transform (DFT) of one variable, extension to functions of two variables, some properties of the 2-D discrete Fourier transform, basics of filtering in the frequency domain, image smoothing, image sharpening, homo- morphic filtering.

UNIT-III

Image Restoration: Noise models, restoration in the presence of noise only-spatial filtering, periodic noise reduction by frequency domain filtering, linear degradation, position-invariant degradation,

estimating the degradation function, inverse filtering, minimum mean square error filtering, constrained least squares filtering, geometric mean filter.

UNIT-IV

Wavelets and Multi Resolution Processing: Background, multi-resolution expansions, wavelet transforms in one dimension, the fast wavelet transform, wavelet transforms in two dimensions, wavelet packets. Image Compression: Fundamentals, image compression models, , lossy compression,.

UNIT-V

Image Segmentation: Fundamentals, point, line and edge detection, thresholding, region-based segmentation, segmentation using morphological watersheds, the use of motion in segmentation. Morphological Image Processing: Preliminaries, erosion and dilation, opening and closing, the Hit-or-Miss transformation, some basic morphological algorithms, some basic gray-scale morphological algorithms.

TEXT BOOKS:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing," 3rd ed., PHI Learning Pvt. Limited, 2008.
2. R. C. Gonzalez, R. E. Woods, and S. L. Eddins, "Digital Image Processing Using MATLAB," 2nd ed., McGraw-Hill, 2010.

SUGGESTED READING:

1. A. C. Bovik, "The Essential Guide to Image Processing," 2nd ed., Elsevier, 2009.
2. A. K. Jain, "Fundamentals of Digital Image Processing," PHI, 2006.
3. W. K. Pratt, "Digital Image Processing," 3rd ed., John Wiley & Sons, Inc., 2001.

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=DSGHkvQBMbs&list=PLuv3GM6-gsE08DuaC6pFUvFaDZ7EnWGX8
2. https://archive.nptel.ac.in/courses/117/105/117105135/

22BTO01

BIOLOGY FOR ENGINEERS
(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: The school level basic knowledge in Fundamental science is required

COURSE OBJECTIVES: This course aims to
1. Understand the milestones reached by human in the field of biology.
2. Understand the human body and its parts.
3. Understand the human anatomy and medical devices.
4. Understand types of advanced therapies.
5. Understand the treatment of toxic pollutants in the environment.
6. Understand genome sequencing and NGS.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Appraise the values of Biology in classical and modern time
2. Develop modern instruments related to skeletal, nervous, and circulatory system
3. Apply concept of respiratory, excretory, and assisted reproductive process for developing related instruments
4. Illustrate the modern interdisciplinary tools related to medical biotechnology and bioremediation
5. Summarize the basic knowledge about nucleic acids, proteins and their sequencing

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	-	2	-	-	-	-	2			
CO 2	1	-	-	-	2	1	-	-	-	-	-			
CO 3	1	-	1	-	2	1	1	-	-	-	-			
CO 4	2	1	1	-	2	2	-	-	1	-	-			
CO 5	1	1	1	-	1	1	-	-	1	-	1			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to Biology: Classical Vs Modern Biology; Importance of Biological Science and Historical developments; Origin of Life, Urey Miller Experiment, Spontaneous Generation Theory; Three Domains of Life; Principle and Applications of Microscope (Light and Electron Microscope), Prokaryotic and Eukaryotic Cell- Structure and their differences.

UNIT-II

Human Anatomy and Functions-I: Human organ systems and their functions; Skeletal System- Bones, Tendon, Ligaments, principle and applications in knee replacement; Nervous System - Structure of Brain, Spinal Cord, Neuron, Neurotransmitters, Synapse, Alzheimer's - a case study, principle and applications of Imaging Techniques (CT & MRI scans); Circulatory System - Heart structure and functions, principle and applications of cardiac devices (Stent and Pacemaker), Artificial heart, blood components and typing, haemocytometer.

UNIT-III

Human Anatomy and Functions-II: Respiratory Systems - Lung structure and function, principle and applications of Peak Flow Meter, ECMO (Extra Corporeal Membrane Oxygenation); Excretory Systems-Kidney structure and function, principle and applications of Dialysis; Prenatal diagnosis; Assisted reproductive techniques- IVF, Surrogacy.

UNIT-IV

Medical Biotechnology and Bioremediation: Cells of Immune System, Etiology of cancer, Cancer treatment (Radiation Therapy); Stem Cells and its Clinical applications; Scaffolds and 3D printing of organs; Bio sensors and their applications; Parts of bioreactor and its types; Bioremediation.

UNIT - V

Bioinformatics: Nucleic acid composition, Genetic Code, Amino acid, Polypeptide, Levels of protein structure, Homolog, Ortholog and Paralog, Phylogenetics, Genome Sequencing, Human Genome Project, Next generation sequencing.

TEXT BOOKS:

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain, S. A. Wasserman, P. V. Minorsky, and R. B. Jackson, "Biology: A Global Approach," 11th ed., Pearson Education Ltd., 2017.
2. D. Shier, J. Butler, and R. Lewis, "Hole's Human Anatomy & Physiology," McGraw-Hill, 2012.

SUGGESTED READING:

1. Bernard R. Glick, T. L. Delovitch, Cheryl L. Patten, “Medical Biotechnology”, ASM Press, 2014.

22CEO02

DISASTER RISK REDUCTION AND MANAGEMENT

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Learn about the types, causes, impacts and management concept of disaster.
2. Learn about the disaster management cycle and early warning systems
3. Make the students become aware of stress and trauma management during a disaster.
4. Identify the role of technology and institutional framework behind disaster management in India.
5. Identify the structural and non-structural measures of disaster mitigation and learn about the provisions of Disaster management Act.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Explain the fundamental concepts of disaster management.
2. Demonstrate the principles and practices of disaster risk reduction management.
3. Identify stress and its management during disaster.
4. Outline institutional framework at different levels of administration.
5. Evaluate disaster management study including data search, analysis and presentation as a case study.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	3	-	-	-	-	-	1	-	-
CO 2	2	-	-	-	-	3	-	-	-	-	-	1	-	-
CO 3	2	-	-	-	-	3	-	-	-	-	-	1	-	-
CO 4	2	-	-	-	2	3	-	-	-	-	-	1	-	-
CO 5	2	-	-	-	-	3	-	-	-	-	-	1	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Fundamental concepts in disaster management: Hazard and disaster-concepts, vulnerability and risk, Hazardand disaster type – Natural, Water- related, pandemic and Human induced hazards disasters. Causes and Impactsof disasters – Impacts on natural eco systems: physical, psychological and social impact. Disaster and financial resilience. Disaster vulnerability profile of India –Specific to geographical regions and states (as per regional significance)

UNIT-II

Disaster Management Cycle: Rescue, Relief, Rehabilitation, Prevention, Mitigation and Preparedness. Disaster risk reduction (DRR). Community based DRR, institutions concerned with safety, disaster mitigation and construction techniques as per Indian standards and Early warning systems

UNIT-III

Disaster Impacts Management: Trauma and stress management, First aid and emergency procedures Awareness generation strategies for the community on safe practices in disaster (as per regional significance)

UNIT-IV

Institutional framework of disaster management in India: NDMA-SDMA, NDRF, civic volunteers, and NIDM. Phases of disaster/risk management and post-disaster responses. Compensation and insurance Applications of remote sensing & GIS in disaster management. Components of disaster management. Preparedness of rescue and relief, mitigation, rehabilitation & reconstruction. Institutional frame work of disaster management in India

UNIT-V

Capacity building for disaster/damage mitigation: Structural and Nonstructural measures for capacity building for disaster/damage mitigation. Disaster risk reduction strategies and national disaster management guidelines. Disaster management Act -2005. Regional issues as per regional requirement/university can take minimum two topics as per high powered committee

TEXT BOOKS:

1. Singh, R. "Disaster management Guidelines for Earth quakes, Landslides, Avalanches and Tsunami". Horizon Press publications, 2017.
2. Taimpo, "Disaster management and preparedness". CRC Press Publications, 2016.

SUGGESTED READING:

1. Nidhi, G.D. (2014), "Disaster management preparedness", CBS Publications Pvt. Ltd.
2. Gupta, A.K.,Nair, S.S., Shiraz, A. and Dey, S., "Flood Disaster Risk Management", CBS Publications Pvt Ltd., 2013.
3. Singh, R., "Disaster management Guidelines for Natural Disasters" Oxford University PressPvt. Ltd., 2016.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/124107010
2. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

22CHO04

ENVIRONMENTAL AND SUSTAINABLE DEVELOPMENT

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Have an increased awareness on issues in areas of sustainability
2. Understand the role of engineering & technology within sustainable development
3. Know the methods, tools and incentives for sustainable product service system development
4. Establish a clear understanding of the role and impact of various aspects of engineering decisions on environmental, societal and economic problems.
5. Communicate results related to their research on sustainable engineering

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the concept of sustainable engineering and its significance in addressing contemporary environmental challenges.
2. Explore the 4R concept of solid waste management and examine various tools and methodologies to assess and mitigate the environmental impacts of engineering activities.
3. Be aware of the principles and requirements of environmental management standards and their application in promoting environmental sustainability.
4. Analyze the challenges and opportunities associated with promoting sustainable habitats such as sustainable cities, sustainable transport, sustainable sources of energy conventional and sustainable materials for green buildings
5. Understand and evaluate the industrial processes through the principles of industrial ecology and industrial symbiosis.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	3	1	1	3	2	1	1	1	3			
CO 2	2	2	3	2	1	3	2	1	1	1	3			
CO 3	2	1	3	1	2	3	2	1	2	1	3			
CO 4	3	1	3	3	1	3	2	2	1	1	3			
CO 5	3	3	3	1	2	3	2	1	1	2	3			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction of sustainability- Need and concept of Sustainable Engineering, Social-environmental and economic sustainability concepts, Sustainable development and challenges, Sustainable Development Goals, Environmental acts and protocols – Clean Development Mechanism (CDM).

UNIT-II

Economic and social factors affecting sustainability, Effects of pollution from natural sources, Solid waste-sources, impacts, 4R (Reduce, Reuse, Recycling, Recover) concept, Ozone layer depletion, Global warming, Tools used to ensure sustainability in engineering activities such as environmental management systems and environmental impact assessment studies.

UNIT-III

Global, Regional and Local environmental issues, Carbon credits and Carbon trading, Carbon foot print, Environmental management standards, ISO 14000 series, Life cycle Analysis (LCA)-scope and goal, Procedures of EIA (Environment Impact Assessment) in India.

UNIT-IV

Basic concept of sustainable habitat-Sustainable cities, Sustainable transport, Sustainable sources of energy conventional and renewable sources, Green Engineering: Green buildings, Green materials for sustainable design, Methods for increasing energy efficiencies of buildings.

UNIT-V

Technology and sustainable development, Sustainable urbanization, Industrialization and poverty reduction, Social and Technological change, Industrial processes-material selection, Pollution prevention, Industrial ecology, Industrial symbiosis.

TEXT BOOKS:

1. R. L. Rag, "Introduction to Sustainable Engineering," 2nd ed., PHI Learning Pvt. Ltd., 2016.
2. D. T. Allen and D. R. Shonnard, "Sustainability Engineering: Concepts, Design and Case Studies," 1st ed., Prentice Hall, 2011.

SUGGESTED READING:

1. A. S. Bradley, A. O. Adebayo, and P. Maria, "Engineering Applications in Sustainable Design and Development," 1st ed., Cengage Learning, 2016.
2. K. R. Reddy, C. Cameselle, and J. A. Adams, "Sustainable Engineering," 1st ed., Wiley, 2019.

ONLINE RESOURCES:

1. Sustainable Engineering concepts and Life cycle analysis https://archive.nptel.ac.in/courses/105/105/105105157/
2. Sustainable Energy Technology https://onlinecourses.nptel.ac.in/noc23_me138/preview

22MEO01

PRINCIPLES OF DESIGN THINKING
(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Nil

COURSE OBJECTIVES: This course aims to
1. Create awareness of design thinking approaches
2. Identify a systematic approach for defining/identifying a problem
3. Create design thinking teams and conduct design thinking sessions collaboratively
4. Apply both critical thinking and design thinking in parallel to solve problems
5. Motivate to apply design thinking concepts to their real life scenarios

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand design thinking and its phases as a tool of innovation
2. Empathize on the needs of the users
3. Define the problems for stimulating ideation
4. Ideate on problems to propose solutions by working as a design thinking team
5. Prototype and test the proposed solutions focusing on local or global societal problems

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1	2	2	2	2	2	2			
CO 2	1	1	2	1	2	2	2	1	2	2	2			
CO 3	1	1	2	2	1	2	2	1	2	2	1			
CO 4	2	1	2	2	1	2	2	1	2	2	2			
CO 5	2	1	2	2	1	2	2	1	2	2	2			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT – I

Introduction to Engineering & Thinking: Impact of science/engineering. Thinking and behaviour; Types of thinking – Linear thinking, lateral thinking, design thinking. **Introduction to Design Thinking**: Importance of Design Thinking & Human centric approach – Phases in design thinking process, five-stage model as iterative method, applications of design thinking in various domains.

UNIT – II

Empathize phase: Understanding the unique needs of the user, empathize with the users, steps in empathize phase, developing empathy towards people, assuming a beginner's mind-set (what? why?), steps in immersion activity, body storming.

UNIT – III

Define phase: Define the problem and interpret the result, analysis and synthesis, Personas – Four different perspectives on Personas, steps to creating personas, problem statement, affinity diagrams, empathy mapping.

UNIT – IV

Ideation phase: What is ideation, need, uses, ideation methods; Brainstorming, rules for brainstorming; Mind maps, guidelines to create mind maps; Ideation games; Six Thinking Hats; use of doodling in expressing creative ideas.

UNIT – V

Prototyping phase: Types of prototyping, guidelines for prototyping, storytelling, characteristics of good stories, reaching users through stories, importance of prototyping in design thinking; guidelines to write value proposition. **Testing phase**: Necessity to test, user feedback, conducting a user test, how to test, desirable, feasible and viable solutions, iterate phase.

TEXT BOOKS:

1. T. Brown, "Change by Design: How Design Thinking Creates New Alternatives for Business and Society," 1st ed., HarperCollins, 2009.
2. M. G. Luchs, S. Swan, and A. Griffin, "Design Thinking: New Product Development Essentials from the PDMA," John Wiley & Sons, 2015.
3. P. Soni, "Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-Solving," Penguin Random House India Pvt. Ltd., 2020.

SUGGESTED READING:

1. J. Liedtka, A. King, and K. Bennett, "Solving Problems with Design Thinking: Ten Stories of What Works," Columbia University Press, 2013.
2. B. Ramadurai, "Karmic Design Thinking: A Buddhism-Inspired Method to Help Create Human-Centered Products & Services," 1st ed., 2020.

22ECO05

PRINCIPLES OF EMBEDDED SYSTEMS
(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Knowledge about computer Architectures, Microprocessors and Microcontrollers.

COURSE OBJECTIVES: This course aims to
1. Learn the fundamentals of the embedded system design.
2. Learn architecture details of embedded processors
3. Analyze various embedded applications and debugging tools.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand hardware and software details of embedded system.
2. Analyze the architecture and instruction set of embedded processors.
3. Develop the embedded system design cycle
4. Apply various debugging tools for embedded system applications.
5. Design different case studies for embedded applications.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	2	3	2	-	2	2	-	2	1	1	1
CO 2	3	3	3	2	2	2	-	2	2	-	2	1	1	1
CO 3	3	3	3	2	3	2	-	2	2	-	2	1	1	1
CO 4	3	3	3	2	2	2	-	2	2	-	2	1	1	1
CO 5	3	3	3	2	3	2	-	2	2	-	2	1	1	1

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to Embedded systems: Embedded systems vs General computing systems, Classifications, Applications areas, Processor embedded into a system, Processor selection for embedded system, Embedded hardware units and devices in a system, Design metrics and Challenges in embedded system design.

UNIT-II

Embedded Processors: PIC 18 Family Overview, Architecture, Instruction Set, Addressing modes, Timers and Interrupts of PIC 18. Capture/Compare and PWM modules of PIC 18.

UNIT-III

Introduction to advanced processor architecture: ARM design philosophy. ARM data flow model, Register organization, Program Status Register, Pipeline, Introduction to exceptions. ARM instruction set, Introduction ARM cortex series, salient features.

UNIT-IV

Embedded System Design Cycle: Embedded system design and co-design issues in system development process, Design cycle in the development phase for an embedded system. Embedded software development tools: Host and Target machines, Linker/Locators for embedded software, Embedded software into the target system.

UNIT-V

Debugging tools and Applications: Integration and testing of embedded hardware, testing methods, Debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, Simulator, Emulator and In-Circuit Emulator, IDE.

Case Studies: Design of Embedded Systems using Microcontrollers – for applications in the area of communications and automotives. (GSM/GPRS, CAN, Zigbee).

TEXT BOOKS:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design," 3/e, Tata McGraw Hill Education, 2015.
2. Andrew N.SLOSS, DomonicSymes Chris Wright "ARM System Developers Guide- Designing and optimizing system software" ELSEVIER 1st Edition2004.
3. Mazidi, MCKinlay and Danny Causey, "PIC Microcontrollers and Embedded Systems", Pearson Education. 2008

SUGGESTED READING:

1. David E.Simon, "An Embedded software primer", Pearson Education,2004.
2. Steve Furber "ARM System on Chip Architecture" 2/e Pearson education, 2000.

22ITC11N

COMPUTER NETWORKS LAB

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to
1. Know about the various network commands.
2. Familiarize with the Configuring Peer to Peer networks and Cisco packet tracer installation.
3. Learn the basic Simulation tools and their installation.
4. Explore the concepts of networks topologies and packet sniffer tool.
5. Acquire knowledge on Socket Programming and SMTP Protocol.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Describe the concepts of Networking commands, Peer to Peer Networks.
2. Implement the Cisco Router and the VLAN.
3. Install the various Simulation Tools in Networks.
4. Solve the Network Problems by using Simulators.
5. Implementing Socket Programming and SMTP protocol.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	2	1	1	-	-	-	-	-	-	-	2	3	3
CO 2	3	2	3	2	1	-	-	-	-	-	-	3	3	2
CO 3	3	1	1	1	1	-	-	-	-	-	-	3	3	3
CO 4	3	2	3	2	1	-	-	-	-	-	-	3	3	2
CO 5	2	2	2	2	1	2	0	2	3	3	3	2	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:
1. Write and analyze the output of various Network commands such as ping, ipconfig, arp, netstat, tracert, nslookup, hostname, system info etc.,
2. Configure Peer to Peer Network with at least three hosts.
3. Implement Cyclic Redundancy Check method.
4. Configuration of Cisco Router and VLAN.
5. Installation setup of Network simulator software (NS2/NS3/ NetSim /OPNET/ QualNet/ OMNet++ / J-Sim and Cisco Packet Tracer).
6. Simulation of Star topology.
7. Simulation of Stop and Wait Protocol,
8. Simulation of Sliding Window Protocol
9. Simulation of the Routing algorithms (Link State Routing/Distance Vector Routing)
10. Use Wireshark Packet sniffer software and captures TCP, UDP, IP, ARP, ICMP, Telnet, FTP packets
11. Implement Socket Programming.
12. Implement SMTP protocol.

TEXT BOOKS:
1. Andrew S. Tanenbaum, "Computer Networks", Pearson Education,6th Edition,2021.
2. Michael Gregg, "Build Your Own Security Lab", Wiley Publishing, Inc., 2008.
3. Michael E Whitman, Herbert J. Mattord, Andrew Green, "Hands on Information Security lab manual", Cengage Learning, Fourth edition, December 27, 2013.

SUGGESTED READING:

1. James F. Kurose, Keith W. Ross, "Computer Networking – A Top-Down Approach Featuring the Internet", 8th Edition, Pearson Education, 2022.

ONLINE RESOURCES:

1. https://nmap.org
2. https://www.snort.org
3. https://www.wireshark.org
4. NS2 Projects Tutorials | How to install NS2 Software | Network Simulation Tools
5. Network Simulator 2 (NS2) : Steps For Installing NS2 (tutorialsweb.com)
6. The Network Simulator ns-2: Documentation (isi.edu)

22CSC18N

OPERATING SYSTEMS LAB

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

PREREQUISITE: Operating systems, Programming for problem solving.

COURSE OBJECTIVES: This course aims to
1. Explore Unix/Linux operating system.
2. Analyze various system calls available in Linux/Unix.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand Linux/Unix environment.
2. Identify and interpret various system programs.
3. Understand and implement shell programming.
4. Simulate memory management, file allocation techniques and process schedules.
5. Analyze process and file management system calls by creating and/or modifying concurrent programs.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	2	-	1	2	1	2	2	2	-	2	2	1	1
CO 2	-	1	1	-	2	2	2	2	2	1	2	2	1	1
CO 3	1	1	1	-	1	2	2	1	2	2	1	1	1	-
CO 4	1	2	2	2	2	1	1	1	1	2	2	1	2	2
CO 5	1	1	-	2	2	1	1	2	2	1	2	1	2	2

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:
1. Demonstration of Linux/Unix file related system calls: mkdir, link, unlink, mount, unmount, users+, chown, chmod, open, close, read, write, lseek, stat, sync.
2. Demonstration of Linux/Unix process related system calls: fork, wait, exec, exit, getpid, getuid, setuid brk, nice, sleep.
3. Shell programming.
4. Implement CPU scheduling algorithms (a) Round Robin (b) SJF (c) FCFS.
5. Implement page replacement algorithms (a) FIFO (b) LRU.
6. Programs to illustrate threads.
7. Demonstration of GNU/Linux IPC mechanisms- Pipes, Semaphores, Shared memory, Message Queues.
8. Implementation of Classical Problems for synchronization (Dining philosopher problem and Producer- Consumer problem).
9. Implementation of Bankers algorithm for Deadlock detection and avoidance.
10. Implementation of Linked, Indexed and Contiguous file allocation methods.

TEXT BOOKS:
1. Galvin, Silberschatz, “Operating System Concepts”, 10th Edition, John Wiley & Sons, 2018.
2. Dhananjay Dhamdhare, “Operating Systems-A Concept Based Approach”, 3rd Edition, McGraw Hill Education, 2017.

SUGGESTED READING:

1. Ekta Walia, "Operating System Concepts", Khanna Book Publishing, 2020.
2. William Stallings, "Operating Systems Internals and Design Principles", Pearson Ed., 2012.
3. Charles Crowley, "Operating Systems –A Design Oriented Approach", McGraw Hill Education, 2017.
4. Andrew S. Tanenbaum, Albert S Woodhull, "Operating systems Design and Implementation", Pearson Ed., 2009.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs88/preview
2. https://onlinecourses.swayam2.ac.in/aic20_sp05/preview

22CSC49

SOFTWARE ENGINEERING LAB

Instruction	3 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

PREREQUISITE: Object Oriented Programming, Software Engineering.

COURSE OBJECTIVES: This course aims to
1. Identify Project Scope, Objectives and infrastructure.
2. Understand Software Engineering methodologies for project development
3. Gain knowledge about Computer Aided Software Engineering (CASE) tools.
4. Use effective communication and technical skills for building quality software.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Identify the problem scope and constraints in the problem.
2. Prepare software requirements specifications (SRS) for the system according to standards.
3. Apply the design notations of a structured approach to develop Data Flow Diagrams.
4. Apply/Use the design notations of UML diagrams.
5. Analyze and prepare the documentation for the proposed system.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	2	1	-	-	-	2	3	2	-	1	-	3
CO 2	1	1	2	1	-	-	-	2	3	-	-	1	-	3
CO 3	2	3	3	1	-	-	-	2	2	-	-	1	-	3
CO 4	2	1	2	2	-	-	-	2	3	-	-	1	-	3
CO 5	-	-	2	-	-	-	-	2	2	-	-	1	-	3

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

Select one large Information System/Approach per each team and device the following:
1. Preparation of Software Requirement Specification Document for a given Case Study.
2. Data Flow Diagrams.
3. Use Case Diagrams.
4. Class Diagrams.
5. Sequence Diagrams.
6. Activity Diagrams.
7. State Chart Diagrams.
8. Component Diagrams.
9. Deployment Diagrams.
10. Given a code snippet representing a simple banking system, reverse engineer a class diagram depicting the classes, attributes, methods, and relationships.

TEXT BOOKS:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: “The Unified Modeling Language User Guide”, Pearson Education, 2010.
2. Roger S. Pressman, “Software Engineering - A Practitioners Approach”, McGraw Hill, 8th Edition, Pearson Education, India, 2014.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/106/105/106105087/

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT of COMPUTER SCIENCE AND ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION
(Inline with AICTE Model Curriculum with effect from AY 2026-27)
(R22A Regulation)

SEMESTER – VI

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22CSC24N	Compiler Design	3	-	-	3	40	60	3
2.	22CSC50	Artificial Intelligence and Machine Learning	4	-	-	3	40	60	4
3.	22CSC52	Data Analysis and Visualization	3	-	-	3	40	60	3
4.	22CSExx	Professional Elective Course-II	3	-	-	3	40	60	3
5.	22CSExx	Professional Elective Course-III	3	-	-	3	40	60	3
6.	22MBC01	Engineering Economics and Accountancy	3	-	-	3	40	60	3
PRACTICAL									
7.	22CSC25N	Compiler Design Lab	-	-	2	3	50	50	1
8.	22CSC51	Artificial Intelligence & Machine Learning Lab	-	-	3	3	50	50	1.5
9.	22CSC26N	Mini Project	-	-	3	-	50	-	1.5
10.	22CSU02	Up Skill Certification Course-II/MOOCs/ NPTEL	-	-	-	-	25	-	0.5
TOTAL			**19**	**-**	**8**	**-**	**415**	**460**	**23.5**

L: Lecture **T: Tutorial** **P: Practical**
CIE: Continuous Internal Evaluation **SEE-Semester End Examination**

Professional Elective-II	
22CSE04	Concurrent Programming
22CSE05	Advanced Database Systems
22CSE06N	Algorithmic Game Theory
22CSE07N	Nature Inspired Algorithms
22CIE53	Blockchain Technology

Professional Elective-III	
22CSE08	User Interface and User Experience Design
22CSE09N	High Performance Computing
22CSE10N	Software Project Management
22CSE21	Extended Reality
22CSE22	Business Analytics

22CSC24N

COMPILER DESIGN

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Formal Language and Automata Theory, Data Structures.

COURSE OBJECTIVES: This course aims to
1. Understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis and design top-down and bottom-up parsers.
3. Implement syntax-directed translation schemes and develop algorithms to generate and optimize code for a target machine and advance topics of compilers.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Identify the concepts related to translators, tokens, bootstrapping, and phases of the compiler.
2. Use grammar specifications and implement a lexical analyzer with the help of compiler tools.
3. Explore the techniques of Top down, bottom-up parsers and apply parsing methods for various grammars.
4. Implement syntax-directed translation schemes and relate Symbol Table organization.
5. Analyze the concepts involved in Intermediate Code, Code Optimization, and Code Generation processes, and understand error recovery strategies and advanced topics in compilers.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	1	-	-	-	-	-	-	3	1	-	2
CO 2	2	2	1	2	3	-	-	-	-	--	-	1	1	2
CO 3	2	2	1	1	3	-	-	-	-	-	1	1	1	2
CO 4	2	2	1	2	-	-	-	-	-	-	1	1	1	2
CO 5	2	2	1	2	3	-	-	-	-	-	2	1	1	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to Compilers: Structure of a compiler, Phases of a compiler, grouping of phases, Compiler writing tools, Bootstrapping, Data structures. **Lexical Analysis:** The role of Lexical Analyzer, Input Buffering, Specification of Tokens using RegularExpressions, Review of Finite Automata, Recognition of Tokens, Design of Lexical Analyzer Generator (lex, flex).

UNIT-II

Syntax Analysis: Introduction to syntax analysis, Top-Down Parsing, Recursive descent parsing, Predictive parsing, LL (1) Grammars. **Bottom-Up Parsing:** Shift Reduce parsing, Operator precedence parsing (Concepts only), Constructing SLR parsing tables, Constructing Canonical LR parsing tables, and Constructing LALR parsing tables. Parser generator (YACC, BISON).

UNIT-III

Syntax-Directed Translation: Syntax-directed definitions, Bottom-up evaluation of S-attributed definitions, L-attributed definitions, Top-down translation, Bottom-up evaluation of inherited attributes. **Type Checking:** Type systems, Specification of a simple type checker, Overview of Symbol Table. **Introduction to Runtime Time Environments:** Storage Organizations, Stack, Heap organizations.

UNIT-IV

Intermediate Code Generation: Intermediate languages, Graphical representations, Three Address code, Quadruples, Triples. **Code Optimization:** Principal sources of optimization, Basic Blocks and Flow Graphs, Optimization of basic blocks, Data Flow Analysis, Live Variable Analysis, Loops.

UNIT-V

Code Generation: Issues in the Design of a Code Generator, The Target Machine, a simple Code Generator, Addresses in Target Code, Machine-independent optimization**,** Peephole optimization, Overview of Register Allocation and Assignment, Error recovery in various phases. **Advanced topics:** Review of Compiler Structure, Advanced elementary topics, Structure of optimizing compilers.

TEXT BOOKS:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, "Compilers: Principles, Techniques &Tools", Pearson Education, 2nd Edition, 2023.
2. Steven Muchnik, "Advanced Compiler Design and Implementation", Kauffman, 1998.

SUGGESTED READING:

1. Kenneth C Louden, "Compiler Construction: Principles and Practice", Cengage Learning, 2005.
2. Keith D Cooper & Linda Tarezon, "Engineering a Compiler", Morgan Kaufman, 3rd Edition, 2022.
3. John R Levine, Tony Mason, Doug Brown, "Lex &Yacc", 3rd Edition, Shroff Publisher, 2007.

ONLINE RESOURCES:

1. http://www.nptel.ac.in/courses/106108052.
2. https://web.stanford.edu/class/archive/cs/cs143/cs143.1128/.
3. http://en.wikibooks.org/wiki/Compiler_Construction.
4. http://dinosaur.compilertools.net/.
5. http://epaperpress.com/lexandyacc/.

22CSC50

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Instruction	4 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

PREREQUISITE: Knowledge on linear algebra, algorithms.

COURSE OBJECTIVES: This course aims to

1. Get the students acquainted with the concepts of different searching techniques of AI systems.
2. Understand the various Machine Learning Algorithms.
3. Familiarize various Classification and Regression techniques.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Define and explain the fundamental concepts, history, and goals of Artificial Intelligence and its key components.
2. Formulate real-world problems using state-space representations and demonstrate suitable AI techniques to effectively solve them.
3. Identify and analyze key features of machine learning techniques and evaluate their applicability to diverse real-world domains.
4. Analyze Classification and Regression models, select suitable algorithms based on problem type, and justify their effectiveness using evaluation metrics.
5. Apply unsupervised learning algorithms to solve real world problems.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	1	2	-	-	-	-	-	-	-	2	1	-
CO 2	3	2	1	2	2	-	-	-	-	-	1	2	1	-
CO 3	3	2	1	2	2	-	-	-	-	-	1	1	1	-
CO 4	3	2	1	3	1	-	-	-	-	-	-	-	1	-
CO 5	3	2	1	3	3	-	-	-	-	-	1	1	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction: Foundations of AI, History, State of the Art, Risks and Benefits. **Intelligent agents:** Agents and Environment, The Concept of Rationality, Structure of an Agent. Solving problems by Search: **Problem-Solving Agents, State space representation, Search graph and Search tree searching for Solutions.**

UNIT-II

Uninformed Search Strategies: Breadth-first search, Uniform cost search, Depth- first search, Iterative deepening Depth-first search, Bidirectional search. **Informed (Heuristic) Search Strategies**: Heuristic Functions, Hill- climbing, Greedy best-first search, A* search **Adversarial Search:** Game Theory, Alpha–Beta Pruning, Constraint Satisfaction Problems.

UNIT-III

Machine Learning: Types of Machine Learning Algorithms - Supervised, Unsupervised and Reinforcement Learning. **Feature Selection and Feature Engineering:** Data sets, Creating training and test sets, managing categorical data, missing features, data scaling and normalization, Whitening, Feature selection and filtering, PCA, Visualization of high-dimensional datasets. **Regression**

Algorithms: Linear models for regression, Regression types, Evaluation Metrics, Hyper parameter tuning, Grid and Random search.

UNIT-IV

Linear Classification Algorithms: KNN, logistic regression, classification metrics, ROC curve. **Naïve Bayes and Discriminant Analysis:** Bayes theorem, Naïve Bayes classifiers, Discriminant analysis. **Support Vector Machines:** Linear SVM, Kernel-based classification.

UNIT-V

Decision Trees and Ensemble Learning: Binary Decision trees, Introduction to Ensemble Learning-Random Forests, AdaBoost, Gradient Tree Boosting, Voting classifier. **Clustering Fundamentals:** Basics, Gaussian mixture, K-means, Evaluation methods, DBSCAN, Spectral Clustering, Hierarchical Clustering.

TEXT BOOKS:

1. Russell, Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education, 2nd Ed., 2015.
2. Giuseppe Bonaccorso, "Machine Learning Algorithms", 2nd Edition, Packt, 2018

SUGGESTED READING:

1. Tom M. Mitchell, "Machine Learning", McGraw Hill, 4th Ed., 2017.
2. Rich, Knight, Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Ed., 2017.
3. Puneet Mathur, "Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance", 1st Ed., Apress, 2019.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Ed., CRC Press, 2014.
5. Saroj Kaushik, "Artificial Intelligence", 1st Ed., Cengage Learning India, 2011.

22CSE52

DATA ANALYSIS AND VISUALIZATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Python Programming

COURSE OBJECTIVES: This course aims to

1. Introduce the Numpy library in Python to support storage and operations on large multi-dimensional arrays and matrices
2. Introduce large collection of mathematical functions to operate on multidimensional sequential data structures
3. Demonstrate the functionality of the Pandas library in Python for open-source data analysis and manipulation
4. Demonstrate Data Aggregation, Grouping and Time Series analysis with Pandas
5. Introduce the Matplotlib library in Python for creating static, animated and interactive visualizations

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Create, manipulate, and analyze numerical data using NumPy arrays and associated functions.
2. Perform various preprocessing operations on datasets using Pandas Series and Data Frame objects.
3. Combine and manipulating complex datasets using a variety of Pandas techniques, including concatenation, merging, grouping, aggregation, and time series analysis,
4. Apply inferential statistics to analyze data, draw valid conclusions about populations, based on hypothesis testing, confidence intervals, and correlation analysis.
5. Create and interpret different types of data visualizations using Matplotlib and Seaborn

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO 2	3	2	-	1	1	-	-	-	-	-	-	1	1	-
CO 3	3	1	-	3	1	-	-	-	-	-	-	2	2	2
CO 4	3	2	1	3	1	-	-	-	-	-	-	2	2	-
CO 5	2	2	-	2	1	-	-	-	-	-	-	2	1	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Introduction to Numpy: Data types in Python - Fixed type arrays, creating arrays, array indexing, array slicing, reshaping arrays, array concatenation and splitting, Universal Functions, Aggregations, Broadcasting rules, Comparisons, Boolean Arrays, Masks Fancy Indexing, Fast Sorting using np.sort and np.argsort, partial sorting Creating Structured Arrays, Compound types and Record Arrays.

UNIT - II

Introduction to Pandas: Series Object, DataFrame Object, Data Indexing and Selecting for Series and DataFrames, Universal Functions for Index Preservation, Index Alignment and Operations between Series and DataFrames, Handling missing data, operating on Null values, Hierarchical Indexing.

UNIT - III

Combining Datasets: Concat, Append, Merge and Joins, Aggregation and Grouping, Pivot Tables,

Vectorized String Operations, High-Performance functions - query() and eval()

UNIT - IV

Time Series : Date and Time Data Types and Tools ,Time Series Basics , Date Ranges, Frequencies, and Shifting ,Time Zone Handling , Time Zone Localization and Conversion , Operations with Time Zone-Aware Timestamp Objects , Operations Between Different Time Zones ,Periods and Period Arithmetic ,Resampling and Frequency Conversion , Moving Window Functions.

UNIT - V

Visualization with Matplotlib : Simple Line plots, Scatter plots, Visualizing errors, Density and Contour plots, Histograms, Binnings, Multiple subplots, Three-dimensional plotting with Matplotlib, Geographic data with Basemap, Visualization with Seaborn.

TEXT BOOKS:

1. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for working with data", 2nd edition, O'Reilly Media, 2023, ISBN:978-1-098-12122-8.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter", 3rd Edition, 2022

SUGGESTED READING:

1. Samir Madhavan, "Mastering Python for Data Science", Packt Publishing, 2015

ONLINE RESOURCES:

1. https://numpy.org/doc/stable/user/index.html
2. https://pandas.pydata.org/
3. https://matplotlib.org/
4. https://seaborn.pydata.org/tutorial.html
5. https://www.coursera.org/learn/data-analysis-with-python

22CSE04

CONCURRENT PROGRAMMING
(Professional Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Operating Systems, Basics of Object-Oriented Programming.

COURSE OBJECTIVES: This course aims to
1. Familiarize the principles for programming secure, reliable, and robust software in a multi-threaded or multi-process environment.
2. Examine the potential run-time problems arising from the concurrent operation of many separate tasks.
3. Make understand the synchronization primitives and develop correct concurrent programs using appropriate programming models.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand and reason about concurrency and concurrent objects.
2. Analyze the concurrent programming algorithms.
3. Interpret concurrent objects for solving problems that require synchronization.
4. Implement the locking and non-blocking mechanisms.
5. Develop the mechanisms for communication and coordination among concurrent processes.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	1	1	-	-	-	-	-	1	1	1	-
CO 2	2	2	1	1	-	-	-	-	-	-	-	1	1	-
CO 3	2	2	1	2	1	-	-	-	-	-	1	1	1	-
CO 4	2	1	1	2	-	-	-	-	-	-	-	1	1	-
CO 5	2	2	1	2	1	-	-	-	-	-	1	1	1	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Introduction - Shared Objects and Synchronization, A Fable, Properties of Mutual Exclusion, The Moral, The Producer–Consumer Problem, The Harsh Realities of Parallelization. Mutual Exclusion - Time, Critical Sections, 2-Thread Solutions, The Peterson Lock, The Filter Lock, Lamport's Bakery Algorithm.

UNIT - II

Concurrent Objects -Concurrency and Correctness, Sequential Objects, Quiescent consistency, Sequential Consistency, Linearizability, Linearization Points, Formal Definitions Linearizability, Compositional Linearizability, The Nonblocking Property, Progress conditions, Dependent Progress Conditions, The Java Memory Model, Locks and synchronized Blocks, Volatile Fields, Final Fields

UNIT - III

Synchronization Operations: Synchronization Operations, Consensus Numbers, Consensus Protocols, The compareAndSet() Operation, Introduction Universality, A Lock-Free Universal, Construction Wait- Free Universal Construction, Spin Locks , Test-And-Set Locks

UNIT- IV

Linked Lists: The Role of Locking, Introduction, List-Based Sets, Concurrent Reasoning, Coarse-Grained Synchronization, Fine-Grained Synchronization, Optimistic Synchronization, Lazy Synchronization, Non-Blocking Synchronization

UNIT - V

Concurrent Queues and the ABA Problem: Concurrent Queues and the ABA Problem, Concurrent Stacks and Elimination, Transactional Memories

TEXT BOOKS:

1. M. Herlihy, N. Shavit, V. Luchangco, and M. Spear, "The Art of Multiprocessor Programming," 2nd ed., Paperback, September 8, 2020, ISBN: 9780124159501, eBook ISBN: 9780123914064.
2. M. Raynal, "Concurrent Programming: Algorithms, Principles, and Foundations," Springer, Berlin Heidelberg, 2015, ISBN: 978-3-642-44615-3.

SUGGESTED READING:

1. M. Charpentier, "Functional and Concurrent Programming: Core Concepts and Features," 1st ed., Addison-Wesley, November 2022.
2. M. Herlihy and N. Shavit, "The Art of Multiprocessor Programming," 1st ed., Indian Reprint, Morgan Kaufmann Publishers, 2012.
3. B. Goetz, T. Peierls, J. Bloch, J. Bowbeer, D. Holmes, and D. Lea, "Java Concurrency in Practice," 1st ed., Addison-Wesley, 2006.
4. D. Lea, "Concurrent Programming in Java™: Design Principles and Patterns," 2nd ed., Addison-Wesley, October 1, 1999.

ONLINE RESOURCES:

1. Elsevier Science -The Art of Multiprocessor Programming, Morgan Kaufmann, September 8, 2020 ISBN: 9780123914064.
2. https://www.researchgate.net/publication/213876653_The_Art_of_Multiprocessor_Programming #fullTextFileContent.
3. The Art of Multiprocessor Programming DOI: 10.1145/1146381.1146382 Source DBLP, Publisher: Elsevier, Inc.
4. Concurrent Programming: Algorithms, Principles, and Foundations | SpringerLink.

22CSE05

ADVANCED DATABASE SYSTEMS
(Professional Elective-II)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE*:* Database knowledge and basic programming.

COURSE OBJECTIVES: This course aims to:
1. Design high-quality databases and database applications.
2. Translate complex conceptual data models into logical and physical database designs.
3. Gain an understanding of NoSql.
4. Have outline knowledge about Parallel and Distributed Databases.
5. Gain experience in Performance Tuning.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand the concept of distributed database and object oriented databases.
2. Develop temporal relationships with constraints.
3. Gain the knowledge of Parallel databases.
4. Understand the design and implement Distributed Databases and NoSQL.
5. Apply the knowledge of Store and retrieve multimedia data.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	-	2	2	-	-	-	-	-	-	-	2	-	1
CO 2	2	-	2	2	-	-	-	-	-	-	-	2	1	1
CO 3	2	-	2	2	-	-	-	-	-	-	-	1	1	1
CO 4	2	2	2	2	-	-	-	-	-	-	-	1	1	1
CO 5	2	2	2	2	-	-	-	-	-	-	-	1	-	1

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Object Based Database Systems: Object Database Concepts Overview: Object Oriented Concepts and Features, Object Identity, Complex data types, Encapsulation of Operations and Object Persistence, Type Hierarchies and Inheritance. Object Based **Extensions to SQL:** User-Defined Types using CREATE TYPE and Complex Objects ODMG Object Model and the Object Definition Language.

UNIT-II

Temporal Database Systems: Temporal Data model: Conceptual Objects, Temporal Objects, temporal Constraints, Temporal and Non Temporal Attributes, Conceptual Relationships, Temporal Relationships and constraints among relationships. The Temporal Query Language: Temporal Projection, Temporal Selection, Temporal Version Restriction Operators, Temporal Scope Operators.

UNIT-III

Parallel Database Systems: I/O Parallelism: Partitioning Techniques, Managing Skew. Inter query Parallelism and Intra query Parallelism, Intra-operator Parallelism (Parallel Sort and Parallel Join).Inter-operator Parallelism: Pipelined Parallelism and Independent Parallelism Query Optimization.

UNIT-IV

Distributed Database Systems: Distributed Database Concepts. Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Concurrency Control and Recovery. NoSQL Databases: Introduction, the CAP theorem, Document based NoSQL systems, NoSQL Key-Value Stores, Column Based NoSQL Systems, NoSQL Graph Databases and Neo4j.

UNIT-V

Creating Distributed Multimedia Presentations: Objects in Multimedia Presentations, Specifying Multimedia Documents with Temporal Constraints, Efficient Solution of Temporal Presentation Constraints, Spatial Constraints. Distributed Media Servers: Distributed multimedia server architecture, distributed retrieval plans, optimal distributed retrieval plans.

TEXT BOOKS:

1. N. R. Adam and B. K. Bhargava, "Advanced Database Systems," Springer-Verlag, Berlin, Heidelberg, New York, ISBN 3-540-57507-3.
2. V. S. Subrahmanian, "Principles of Multimedia Database Systems," Morgan Kaufmann.

SUGGESTED READING:

1. R. Elmasri and S. B. Navathe, "Fundamentals of Database Systems," 7th ed., Pearson Education, 2017.
2. L. Dunckley, "Multimedia Databases: An Object Relational Approach," Pearson Education.

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/106/105/106105175/
2. https://nou.edu.ng/coursewarecontent/NATIONAL%20OPEN%20UNIVERSITY%20OF%20NIGERIA.pdf

22CSE06N

ALGORITHMIC GAME THEORY
(Professional Elective – II)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Linear Algebra and Calculus, Data Structures.

COURSE OBJECTIVES: This course aims to
1. Introduce the fundamental principles of non-cooperative and cooperative game theory, and their algorithmic implications.
2. Explore key concepts such as Nash equilibrium, dominant strategies, and solution concepts in strategic games.
3. Provide insights into mechanism design, auctions, and pricing mechanisms with truthfulness and efficiency as goals.
4. Develop the ability to model and analyze networked systems, congestion, and distributed decision-making using game-theoretic tools.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Analyze and classify strategic games and compute pure and mixed strategy Nash equilibria.
2. Apply algorithmic techniques to determine optimal strategies in zero-sum and multi-player games.
3. Design truthful and efficient mechanisms and understand auction formats and their strategic properties.
4. Evaluate the impact of selfish behaviour in networks using concepts like the Price of Anarchy and Wardrop equilibrium.
5. Model real-world problems as cooperative or non-cooperative games and implement basic algorithms for fair division and matching markets.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	-	1	-	-	1	3	1	-	-	1	1	-	-
CO 2	3	2	1	1	-	1	3	2	-	-	1	1	-	-
CO 3	3	2	1	1	1	1	3	2	-	1	1	1	-	-
CO 4	3	1	1	1	1	1	2	-	-	-	-	1	-	-
CO 5	3	2	1	1	2	1	3	2	-	-	-	1	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Introduction to Game Theory: Basic concepts: Players, strategies, payoffs, outcomes**,** Types of games: Normal-form and extensive-form games**,** Nash Equilibrium: Definition, existence (Nash's Theorem), examples**,** Dominant and dominated strategies**,** Best response dynamics.

UNIT - II

An Introduction to Voting, The Game of Trust - Nicky Case's Interactive Essay, Arrow's Theorem, Gibbard- Satterethwaite Theorem, Domain Restrictions and Multi-winner Elections, Incentive Design in Crowd sourcing Applications.

UNIT - III

Complexity of Finding Equilibria: Computing Nash Equilibrium: PPAD-completeness**,** Approximate equilibria**,** Zero-sum games and the Minimax theorem**,** Linear programming for solving two-player

zero-sum games**,** Lemke-Howson algorithm. **Mechanism Design and Auctions:** Introduction to mechanism design**,** Incentive compatibility and truthfulness**,** Vickrey and VCG auctions**,** Revenue maximization**,** Single-item and combinatorial auctions**,** Myerson's Lemma.

UNIT - IV

Network and Congestion Games: Congestion games and potential games**,** Price of Anarchy and Price of Stability**,** Routing in networks: selfish routing**,** Braess's paradox**,** Wardrop equilibrium

UNIT - V

Cooperative Game Theory and Applications: Cooperative games: Core, Shapley value, and applications**,** Matching markets and stable matchings (Gale-Shapley algorithm)**,** Applications in blockchain, cloud computing, and distributed systems**,** Fair division and cake-cutting

TEXT BOOKS:

1. N. Nisan, T. Roughgarden, É. Tardos, and V. V. Vazirani, "Algorithmic Game Theory," Cambridge University Press.
2. M. M. Maschler, E. Solan, and S. Zamir, "Game Theory for Computer Scientists," Cambridge University Press.

SUGGESTED READING:

1. M. J. Osborne, "An Introduction to Game Theory," Oxford University Press.
2. S. Tadelis, "Game Theory: An Introduction," Princeton University Press.
3. H. Gintis, "Game Theory Evolving," Princeton University Press.

ONLINE RESOURCES:

1. Stanford CS364A: Algorithmic Game Theory
2. https://timroughgarden.org/
3. MIT OpenCourseWare – Algorithmic Game Theory
4. https://ocw.mit.edu
5. https://gametheorysociety.org/
6. https://ocw.mit.edu/courses/14.126-game-theory-spring-2024/download/

22CSE07N

NATURE INSPIRED ALGORITHMS
(Professional Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Mathematics, Basic programming knowledge

COURSE OBJECTIVES: This course aims to
1. Introduce the fundamentals of optimization techniques, highlighting the differences between classical and metaheuristic approaches with a focus on nature-inspired algorithms.
2. Explore the principles and mechanisms behind evolutionary and swarm intelligence algorithms, including their biological inspirations and practical relevance.
3. Analyze and compare a range of nature-inspired algorithms, such as Genetic Algorithms, PSO, ACO, Simulated Annealing, and others, along with their applications.
4. Enable students to apply and evaluate optimization techniques in real-world domains like engineering design, machine learning, and data science using appropriate performance metrics

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Differentiate between classical and metaheuristic optimization techniques and explain the role of natural inspiration in algorithm design.
2. Demonstrate a deep understanding of evolutionary algorithms, including their operators, convergence behaviour, and applications.
3. Apply swarm intelligence techniques such as PSO, ACO, and ABC to solve optimization problems in various domains.
4. Evaluate and implement other nature-inspired algorithms like Simulated Annealing, Firefly Algorithm, and Bat Algorithm for complex problem-solving.
5. Design and Develop hybrid and memetic algorithms for optimization solutions and assess their effectiveness using standard performance metrics and benchmarking methods.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	1	1	1	-	1	-	-	-	-	1	-	1	-
CO 2	2	2	2	1	-	1	-	-	-	-	1	-	1	-
CO 3	2	1	1	1	-	1	-	-	-	-	1	-	1	-
CO 4	2	2	1	1	-	1	-	-	-	-	1	-	1	-
CO 5	2	1	1	1	-	1	-	-	-	-	1	-	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT- I

Introduction: Overview of Optimization Techniques, Classical vs. Metaheuristic Algorithms, Biological Inspiration Behind Algorithms, Evolutionary processes, Swarm behavior, Natural selection, Classification of Nature-Inspired Algorithms, Evolutionary, Swarm-based, Physics-based, Ecology-based, Applications & Real-World Relevance, Engineering, Data Science, Machine Learning, Robotics

UNIT- II

Evolutionary Algorithms: Genetic Algorithms (GAs), Chromosomes, Selection, Crossover, Mutation, Fitness Functions and Convergence, Differential Evolution (DE), Mutation, Recombination, and

Selection, Genetic Programming (GP), Applications, Function optimization, Scheduling, Feature Selection

UNIT -III

Swarm Intelligence Algorithms: Particle Swarm Optimization (PSO), Social & Cognitive Components, Velocity Update, Inertia, Ant Colony Optimization (ACO), Pheromone Updating, Path Finding, Convergence, Artificial Bee Colony (ABC), Applications, Routing, Image Processing, Clustering, Path Planning

UNIT -IV

Other Inspired Techniques: Simulated Annealing (SA), Metaphor, Cooling Schedule, Acceptance Probability, Firefly Algorithm (FA), Attraction, Light Intensity, Movement Equation, Cuckoo Search (CS) & Levy Flights, Bat Algorithm, Harmony Search, Comparative analysis.

UNIT -V

Applications and Implementation: Real-world Applications, Optimization in Power Systems, Mechanical Design, Network Design, Feature Selection in Machine Learning, Hybrid Algorithms & Memetic Computing, Performance Metrics & Benchmarking.

TEXT BOOKS:

1. X.-S. Yang, "Nature-Inspired Optimization Algorithms," Elsevier, 2014.
2. S. N. Sivanandam and S. N. Deepa, "Introduction to Genetic Algorithms," Springer, 2008.

SUGGESTED READING:

1. A.P. Engelbrecht, "Computational Intelligence: An Introduction," Wiley, 2007.
2. M. Dorigo and T. Stützle, "Ant Colony Optimization," MIT Press, 2004.
3. R. Storn and K. Price, "Differential Evolution – A Simple and Efficient Heuristic for Global Optimization over Continuous Spaces," Journal of Global Optimization, 1997.
4. A.E. Eiben and J. E. Smith, "Introduction to Evolutionary Computing," 2nd ed., Springer, 2015.

ONLINE RESOURCES:

1. https://www.nptel.ac.in/courses/106/106/106106228/
2. https://ocw.mit.edu/courses/15-053-optimization-methods-in-management-science-spring-2013/
3. https://www.nptel.ac.in/courses/106/106/106106228/
4. coursera.org/learn/swarm-intelligence
5. Beyond Gisin's Theorem and its Applications: Violation of Local Realism by Two-Party Einstein-Podolsky-Rosen Steering

22CIE53

BLOCKCHAIN TECHNOLOGY
(Professional Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Distributed systems, Computer networks and Basic understanding of programming concepts.

COURSE OBJECTIVES: This course aims to
1. Get acquainted with the foundations of blockchain.
2. Provide the significance of the bitcoin ecosystem.
3. Explore the consensus mechanisms and technologies that support Ethereum.
4. Introduce Hyperledger Fabric and its architecture.
5. Familiarize blockchain use cases in various domains.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand the significance of distributed systems and blockchain.
2. Explain the concepts of bitcoin and consensus mechanisms in bitcoin mining.
3. Explore the consensus mechanisms and technologies that support Ethereum.
4. Describe Hyperledger Fabric architecture and Hyperledger projects.
5. Analyse blockchain use cases in various domains.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	3	1	-	-	1	-	1	3	3	3
CO 2	3	3	2	1	3	2	-	-	2	-	1	3	3	3
CO 3	3	3	2	1	3	2	-	-	1	-	2	3	3	3
CO 4	3	3	2	2	2	1	-	-	2	-	2	3	3	2
CO 5	3	3	2	2	3	2	-	-	2	-	1	3	3	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Blockchain Foundations: Overview of distributed systems, Introduction to blockchain, Generic elements of a blockchain, Features of blockchain, Applications of blockchain, Hash Functions and Merkle Trees, Components of blockchain Ecosystem, Cryptography and Consensus Algorithms, Types of blockchain, Blockchain Platforms.

UNIT-II

Bitcoin Platform: Bitcoin definition, Keys and addresses, public keys and Private keys in bitcoin, The transaction life cycle, The transaction structure, Bitcoin payments, Consensus mechanism in bitcoin, Wallet types, Non-deterministic wallets, Deterministic wallets, Alternative Coins: Namecoin, Litecoin, Zcash.

UNIT–III

Ethereum Blockchain: Introducing Smart Contracts, Ethereum blockchain, The Ethereum stack, Ethereum virtual machine (EVM), Consensus mechanism in Ethereum, The Ethereum network, Ethereum Development, Setting up a development environment, Development tools: Remix IDE, Truffle, Ganache.

UNIT-IV

Hyperledger Fabric: Introduction to Hyperledger Fabric, Hyperledger Fabric architecture, Membership services, Hyperledger Projects: Fabric, Sawtooth, Iroha, Components of the Fabric, Alternate blockchains- Ripple, Corda, Hyperledger Smart Contracts (Chaincode).

UNIT-V

Case studies using blockchain: Cross border payments, Know Your Customer (KYC), Food supply chain, Mortgage over blockchain, Identity on blockchain, Blockchain in Insurance Industry, Education, Healthcare, Real estate management and Metaverse.

TEXT BOOKS:

1. Imran Bashir, “Mastering Blockchain - A technical reference guide to the inner workings of blockchain, from cryptography to DeFi and NFTs”, Packt Publishing Ltd, Fourth Edition, 2023.
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", First Edition, O'Reilly, 2018.

SUGGESTED READING:

1. Andreas M. Antonopoulos, “Mastering Bitcoin Unlocking Digital Cryptocurrencies”, First Edition Apress, 2017.
2. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and BlockChain”, Packt Publishing, 2019.
3. Ramchandra Sharad Mangrulkar, Pallavi Vijay Chavan, “Blockchain Essentials - Core Concepts and Implementations”, APress Publishing, 2024.

ONLINE RESOURCES:

1. https://andersbrownworth.com/blockchain/public-private-keys/
2. https://www.hyperledger.org/projects/fabric
3. NPTEL courses:
   a. Blockchain and its Applications,
   b. Blockchain Architecture Design and Use Cases

22CSE08

USER INTERFACE AND USER EXPERIENCE DESIGN

(Professional Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Fundamental Computer Skills, Knowledge of Web Technologies.

COURSE OBJECTIVES: This course aims to

1. Familiarize students with the fundamental principles and concepts of user interface (UI) and user experience (UX) design.
2. Equip students with the practical skills and knowledge necessary to design effective UI/UX interfaces.
3. Understand the importance of applying user-centered design methods throughout the design process.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Apply user-centered design principles to create interfaces that meet the needs and preferences of target users.
2. Demonstrate proficiency in designing intuitive user interfaces that are easy to navigate and understand.
3. Develop the skills to create wireframes, prototypes, and mockups using industry-standard design tools.
4. Gain an understanding of accessibility guidelines and principles, designing interfaces that are accessible to users with disabilities.
5. Identify emerging trends and technologies in UI/UX design.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	3	3	3	3	3	3	3	1	1	2
CO 2	3	3	3	3	3	3	3	3	3	3	3	1	-	3
CO 3	2	3	3	3	3	2	-	3	3	3	3	1	1	-
CO 4	3	3	3	3	3	3	-	3	3	3	3	1	-	-
CO 5	3	3	1	2	2	1	-	3	3	1	-	1	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Introduction to UI/UX Design: Understanding UI/UX Design: Definition and importance of UI/UX design, Difference between UI and UX, Roles and responsibilities of UI/UX designers, Overview of the design process. **User-Centered Design Principles**: Principles of user-centered design, User research methods (interviews, surveys and observations), Creating user personas and scenarios, Conducting user journey mapping exercises.

UNIT – II

Design Fundamentals: Basic principles of visual design (layout, typography, color),Gestalt principles and their application in UI design, applying visual hierarchy to improve user experience, Introduction to design tools (Sketch, Figma, Adobe XD) **Interaction Design**: Principles of interaction design, Designing effective navigation systems, Feedback mechanisms and user affordances Prototyping techniques for interaction design

UNIT - III

Usability and User Testing: Understanding usability principles, Nielsen's heuristics for user interface design, conducting heuristic evaluations of UI designs, Usability testing methods (moderated vs. unmoderated, remote testing) **User Testing and Feedback:** Planning and conducting usability tests, analyzing usability test results incorporating user feedback into UI design iterations, Best practices for iterative design and testing cycles

UNIT - IV

Accessibility in UI/UX Design: Understanding accessibility guidelines (WCAG), Designing accessible interfaces for users with disabilities, Assistive technologies and their impact on UI/UX design. **Emotional Design and Engagement**: Principles of emotional design, creating emotionally engaging user experiences, Strategies for enhancing user engagement and retention, Case studies of emotionally successful UI/UX designs.

UNIT - V

Responsive and Mobile Design: Principles of responsive web design, Mobile-first design approach, adapting layouts and content for different screen sizes, Testing and debugging responsive designs. **Designing for Mobile Platforms**: Mobile UI design patterns and conventions, Navigation and interaction patterns for mobile apps, Challenges and best practices for designing mobile interfaces, Introduction to mobile prototyping tools (InVision, Marvel)

TEXT BOOKS:

1. S. Krug, "Don’t Make Me Think," Rider Publication, 2006.
2. D. Norman, "The Design of Everyday Things," Basic Books, 2013.

SUGGESTED READING:

1. J. K., "Design Basics Index," How Books, 2010.
2. W. Lidwell, K. Holden, and J. Butler, "Universal Principles of Design," Rockport Publishers, 2010.

ONLINE RESOURCES:

1. User Interface Design - Course (nptel.ac.in)
2. Introduction to User Experience Design Course (Georgia Tech) | Coursera

22CSE09N

HIGH PERFORMANCE COMPUTING
(Professional Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Computer Architecture, Computer Networks Operating Systems

COURSE OBJECTIVES: This course aims to
1. Understand the relevance of High performance computing, architectures and various computational models.
2. Learn basic of Open MP.
3. Learn basics of GPU.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand the significance of High Performance Computing and HPC Architecture, Systems and Technologies.
2. Apply models and methodologies for parallel programming and application development.
3. Describe the message passing interface concepts.
4. Explain the architecture of GPU and Edge Computing on SoC.
5. Describe about high performance storage technologies.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	1	1	2	1	-	-	-	1	-	-	2	2	2
CO 2	2	2	3	1	1	-	-	-	1	-	-	3	2	-
CO 3	2	1	1	1	1	-	-	-	1	-	-	2	1	-
CO 4	2	1	2	1	1	-	-	1	1	2	-	2	1	-
CO 5	2	2	-	2	1	-	-	-	1	2	1	2	1	2

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT – I

Introduction – High Performance Computing Disciplines, impact of supercomputing on science, society and security; anatomy of a supercomputer, compute performance, a brief history of Supercomputing.

UNIT - II

HPC Architecture, Systems and Technologies: Key properties of HPC, Architecture, Parallel architecture families, Flynn's taxonomy, enabling technology, Van Neumann sequential processors, vector and pipelining, Single instruction Multiple Data Array, Multiprocessors, Heterogeneous computer structures.

Commodity Clusters: Hardware architecture, Programming interfaces, Software environments.

UNIT – III

Symmetric Multiprocessor Architecture: Architecture overview, Amdahl's Law Plus, Processor Core architecture, memory hierarchy, PCI Bus, external interfaces. **OpenMP**: Overview of OpenMP programming model, parallel threads and loops, synchronization, reduction.

UNIT-IV

Distributed memory parallel Programming with MPI: Message passing interface standards, MPI basics, communicators, point-to-point messages, synchronization collectives, communication collectives, non-blocking point-to-point communication, user-defined data types.

UNIT – V

Accelerator Architecture: Historic perspective, introduction to Graphics Processing Units, evolution of GPU functionality, modern GPU architecture, heterogeneous system architecture, introduction to System on Chip SoC), HPC on SoC, types of SoC, Edge Computing, High Performance on Edge devices. **Mass Storage:** Brief history of storage, storage device technology, aggregated storage, high performance storage, all flash/SSD.

TEXT BOOKS:

1. Thomas Sterling, Mathew Anderson, "High Performance Computing: Modern Systems and Practices", 1st Edition, Morgan Kaufman Publishers, 2017

SUGGESTED READING:

1. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science Series, 2011.
2. Charles Severance, Kevin Dowd, "High Performance Computing", OpenStx CNX, 2021.

ONLINE REFERENCES:

1. https://nptel.ac.in/courses/106108055.
2. https://prace-ri.eu/wp-content/uploads/Edge-Computing-An-Overview-of-Framework-and-Applications.pdf.

22CSE10N

SOFTWARE PROJECT MANAGEMENT
(Professional Elective -III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Software engineering

COURSE OBJECTIVES: This course aims to
1. Develop a comprehensive understanding of software project management frameworks
2. Build practical skills in planning, risk management, and quality assurance
3. Understand and apply organizational and human resource management principles

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Aanalyze and apply software process maturity models and frameworks
2. Develop and manage effective project activity plans and risk management strategies
3. Analyze and apply organizational structures and project control mechanisms
4. Effectively manage human resources in software projects
5. Plan, execute, and control software projects by applying principles of software configuration management, quality assurance, and risk analysis.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	-	-	-	-	-	-	-	-	-	1	-	3
CO 2	1	3	1	2	1	1	-	2	3	1	-	1	-	3
CO 3	1	2	2	-	-	-	-	2	1	-	-	1	-	3
CO 4	1	-	-	-	-	-	-	3	2	-	-	1	-	3
CO 5	1	2	2	-	-	-	-	3	3	1	-	1	-	3

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Software Process Maturity Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process. Process Reference Models Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP)

UNIT - II

Activity Planning and Risk Management: Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling -Network Planning models – Formulating Network Model – Forward Pass and Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning -Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT - III

Project Organizations Line-of- business organizations, project organizations, evolution of organizations, process automation. Project Control and process instrumentation, The seven-core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, metrics automation.

UNIT - IV

Staffing in Software Projects: Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

UNIT - V

Software configuration management, Software Quality assurance, Risk Analysis, Instream activities- Project Initiation, Project planning and tracking, Project closure.

TEXT BOOKS:

1. W. Royce, "Software Project Management," Pearson Education, 2014.
2. R. Gopalaswamy, "Managing Global Software Projects," Tata McGraw-Hill, 2002.

SUGGESTED READING:

1. W. S. Humphrey, "An Introduction to the Team Software Process," Pearson Education, 2000.
2. J. R. Persse, "Process Improvement Essentials," O'Reilly, 2006.
3. B. Hughes and M. Cotterell, "Software Project Management," 4th ed., Tata McGraw-Hill, 2006.
4. A. Stellman and J. Greene, "Applied Software Project Management," O'Reilly, 2006.
5. J. Greene and A. Stellman, "Head First PMP," O'Reilly, 2007.
6. R. H. Thayer and E. Yourdon, "Software Engineering Project Management," 2nd ed., Wiley India, 2004.
7. J. Highsmith, "Agile Project Management," Pearson Education, 2004.

ONLINE RESOURCES:

1. Software Project Management - Course (nptel.ac.in)
2. Software Engineering: Software Design and Project Management Course by The Hong Kong University of Science and Technology | Coursera

22CSE21

EXTENDED REALITY
(Professional Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	3

PREREQUISITE: Basic knowledge on computer hardware and software components.

COURSE OBJECTIVES: This course aims to
1. Understand immersive technology current state of development for designing and developing immersive experiences.
2. Understand the sensory, emotional and narrative immersion for best practice user interface and experience design.
3. Understand the intersection of AI and VR/XR, looking at how AI is being used to improve everything from graphics rendering to user interaction.
4. Understand the applications of VR/XR in healthcare, discussing the latest research, challenges and opportunities for healthcare professionals.
5. Understand the design principles that guide the creation of immersive experiences, from 3D modelling to user interface design.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Define and explain principles in immersive technology for designing and developing immersive experiences.
2. Explain the sensory, emotional and narrative immersion for best practice user interface and experience design.
3. Model and create intersection of AI and VR/XR to user interaction.
4. Design the applications of VR/XR in healthcare, discussing the latest research, challenges and opportunities for healthcare professionals.
5. Choose the creation of immersive experiences, from 3D modelling to user interface design.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	1	-	-	-	-	-	3			
CO 2	3	3	3	3	2	-	-	-	-	-	3			
CO 3	3	3	3	3	3	-	-	-	-	-	3			
CO 4	3	3	3	3	3	-	-	-	-	-	3			
CO 5	3	3	3	3	3	-	-	-	-	-	3			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT -I

Immersive Technology: Introduction Promise and Potential, Knowing immersive technologies - AR/VR/ExR, Overview of immersive technologies, AR/VR Milestones and breakthroughs, Current state, Statistical data, Potential and Limitations of immersive technologies. **3D UI and Hardware requirements. Software Technologies used. AR and VR Environment.**.

UNIT-II

Designing Immersive Experience - Introduction, designing for sensory immersion, Designing for emotional immersion, Designing for narrative immersion, Best practices for user interface and experience design. **Evolution of VR Hardware -** Introduction to virtual reality hardware, The rise of

consumer virtual reality, Virtual reality hardware design challenges, The future of virtual reality hardware, Role of haptic feedback on virtual reality hardware, **Tools of VR kits** and Case studies.

UNIT-III

AI in AR/VR/XR: -Introduction, AI and its usage in VR/AR, Graphic rendering, Natural language processing, User interaction, Predictive analytics. **Business Landscape of AR/VR/XR-** Introduction, Funding and investment, Funding and its challenges for VR/XR industry, Monetization strategies, User adoption and marketing, Technology challenges, Case studies.

UNIT-IV

Applications of AR/VR/XR in Healthcare: -Introduction, Diagnosis and treatment, Rehabilitation and physical therapy Medical education and training, Use of immersive technology in patient education and engagement, Case studies, Design principles, Medical realities. **Applications of AR/VR/XR in Education:** Introduction, Immersive learning environment, Simulations and training, Personalized learning, Collaborative learning, Case studies.

UNIT -V

Ethics in Immersive Technologies: Introduction to ethics in immersive technologies, Safety and physical health Psychological and emotional impact, Case studies. **3D Modeling and User Interface Design:** Introduction to 3D modelling, Modelling technique, User interface design principles, User interface design software and workflow, Implementing UIs in 3D environment, **Case Study:** Building VR Applications with Unity.

TEXT BOOKS:

1. S. Dutta, "Immersive Realm of Extended Reality," 1st ed., BPB Publications, India, 2024. ISBN: 978-93-55517-227.

SUGGESTED READING:

1. S. M. LaValle, "Virtual Reality," University of Oulu, Cambridge University Press.
2. Z. Tacgin, "Virtual and Augmented Reality: An Educational Handbook," Cambridge Scholars Publishing, Newcastle upon Tyne, UK.
3. G. C. Burdea and P. Coiffet, "Virtual Reality Technology," John Wiley & Sons, 2003.
4. B. Furht, "Handbook of Augmented Reality," Springer, New York, NY. Hardcover ISBN 978-1-4614-0063-9, eBook ISBN 978-1-4614-0064-6.

ONLINE RESOURCES:

1. https://axisxr.gg/the-future-of-xr-trends-to-look-for-in-2024/
2. https://www.interaction-design.org/literature/topics/extended-reality-xr
3. https://www.accenture.com/us-en/services/technology/extended-reality
4. https://www.sngular.com/insights/235/extended-reality-will-it-be-more-widespread-in-2024

22CSE22

BUSINESS ANALYTICS
(Professional Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Introduction to Data Science

COURSE OBJECTIVES: This course aims to
1. Introduce the fundamental concepts and methods of Business Analytics and their applications in real-world business decision-making.
2. Develop the ability to summarize and visualize business data using descriptive statistics and visualization tools.
3. Equip students with predictive modeling and forecasting techniques, including regression and data mining methods.
4. Expose students to optimization techniques and decision analysis under risk and uncertainty.
5. Able to apply linear programming techniques to optimize business operations and utilize decision analysis

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Define and explain the scope, methods, and importance of Business Analytics in the modern business
2. Apply descriptive analytics and data visualization techniques using tools like MS Excel or SPSS to summarize business data.
3. Build and interpret predictive models using regression analysis, forecasting techniques, and data mining approaches.
4. Analyze business problems using optimization and decision-making models under conditions of uncertainty.
5. They will learn to formulate and solve real-world optimization problems

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	1	1	-	-	-	-	-	-	-	2	-
CO 2	3	2	-	1	1	-	-	-	-	-	-	-	1	-
CO 3	3	2	-	1	1	-	-	-	-	-	-	-	2	-
CO 4	3	2	-	1	1	-	-	-	-	-	-	-	2	-
CO 5	3	2	-	1	1	-	-	-	-	-	-	-	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT – I

Introduction To Business Analytics: Definition of Business Analytics, Categories of Business Analytical methods and models, Business Analytics in practice, Big Data - Overview of using Data, Types of Data- Business decision modelling.

UNIT – II

Descriptive Analytics: Overview of Description Statistics (Central Tendency, Variability), Data Visualization -Definition, Visualization Techniques – Tables, Cross Tabulations, charts, Data Dashboards using Advanced Ms-Excel or SPSS.

UNIT – III

Predictive Analytics: Trend Lines, Regression Analysis – Linear & Multiple, Predictive modelling, forecasting Techniques, Data Mining - Definition, Approaches in Data Mining- Data Exploration & Reduction, Data mining and business intelligence, Data mining for business, Classification, Association, Cause Effect Modelling.

UNIT – IV

Prescriptive Analytics: Overview of Linear Optimization, Non-Linear Programming Integer Optimization, Cutting Plane algorithm and other methods, Decision Analysis – Risk and uncertainty methods - Text analytics Web analytics

UNIT – V

Optimization And Decision Analysis: Linear Programming and Optimization, Formulating and solving linear programming problems. Decision Analysis and Simulation, Techniques for making decisions under uncertainty using simulation methods.

TEXT BOOKS:

1. J. Camm, J. Cochran, M. Fry, M. Ohlmann, D. Anderson, D. Sweeney, and T. Williams, "Essentials of Business Analytics," Cengage Learning.
2. J. Evans, "Business Analytics," Pearson.

SUGGESTED READING:

1. D. Albright and W. Winston, "Business Analytics: Data Analysis and Decision Making," Cengage Learning, Reprint.
2. S. Raj, "Business Analytics," Cengage Learning.

22MBC01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Demonstrate the importance of Managerial Economics in Decision Making.
2. Explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. Understand the importance of Project Evaluation in achieving a firm's Objective.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make best use of resources available.
4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	3	1	1	1	-	1	1	1	-	1	-	-
CO 2	2	2	2	2	-	1	-	1	-	1	-	1	-	-
CO 3	1	2	1	2	2	1	-	1	-	1	-	1	-	1
CO 4	2	2	1	2	2	1	-	3	-	1	-	1	-	-
CO 5	1	3	1	2	1	1	-	-	-	1	2	1	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to Managerial Economics: Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

UNIT-II

Demand and Supply Analysis: Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

UNIT-III

Production and Cost Analysis: Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns. Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features of Perfect Competition, Price Output Determination under Perfect Competition, Features of Monopoly Competition, Price Output Determination under Monopoly Competition Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

UNIT-IV

Accountancy: Book-keeping, Principles and Significance of Double Entry Bookkeeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.

UNIT-V

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

TEXT BOOKS:

1. Mehta P.L., "Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", 12th Edition, Vikas Publishing House, 2018.

SUGGESTED READING:

1. Panday I.M. "Financial Management", 11th edition, Vikas Publishing House, 2016.
2. Varshney and K L Maheswari, Managerial Economics, Sultan Chand, 2014.
3. M. Kasi Reddy and S. Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
4. R. Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2018

22CSC25N

COMPILER DESIGN LAB

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

PREREQUISITE: Data Structures, Design and analysis of algorithms, Formal language and automata theory.

COURSE OBJECTIVES: This course aims to

1. Define the rules for implementing a lexical analyzer and to understand the concepts behind the working of compiler tools - Lex, Turbo C, Yacc.
2. Analyze and apply regular grammar for various source statements' expressions.
3. Implement the front end of the compiler by means of generating intermediate codes, implementing code optimization techniques, and error handling.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Implement the rules for the analyzing phases of a compiler.
2. Examine the concepts of compiler tools: Lex, Flex, Yacc, Turbo C.
3. Apply various Syntax techniques on grammars to build the parsers.
4. Generate various intermediate code representations for the source code.
5. Implement the concepts of code optimization, code generation phases.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	-	1	-	-	-	-	-	-	3	2	1	-
CO 2	2	2	1	1	3	-	-	-	-	-	3	2	1	-
CO 3	2	2	1	1	3	-	-	-	-	-	3	2	1	-
CO 4	2	2	1	1	2	-	-	-	-	-	3	2	1	-
CO 5	2	2	1	1	2	-	-	-	-	-	3	2	1	2

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF PROGRAMS:

1. Tokenization – By constructing a DFA of the Lexical Analyzer.
2. Writing a standalone scanner application using (Tools: Jlex / JFlex / Lex).
3. Implementing a parser with Scanner, without Scanner, or with yacc/bison generators.
4. Program to generate a predictive LL1 parsing table for the Expression grammar.
5. Program to generate the SLR parsing table for the Expression grammar.
6. Implementing a parser for a small language.
7. Implementation of the language to an intermediate form (e.g., three-address code).
8. Demonstration of code improvement with the help of optimization techniques.
9. Generation of target code (in assembly language).
10. Implement a Mini Compiler with Phases.

TEXT BOOKS:

1. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D Ullman, “Compilers: Principles, Techniques &Tools”, Pearson Education, 2nd Edition, 2023.
2. John R Levine, Tony Mason, Doug Brown, “Lex &Yacc”, 3rd Edition, Shroff Publisher, 2007.

SUGGESTED READING:

1. Keith D Cooper & Linda Tarezon, "Engineering a Compiler", Morgan Kaufman, 3rd Edition, 2022.
2. John R Levine," Lex & Yacc", 2nd Edition, O'Reilly Publishers, 2009.

ONLINE RESOURCES:

1. http://www.nptel.ac.in/courses/106108052
2. http://en.wikibooks.org/wiki/Compiler_Construction
3. http://dinosaur.compilertools.net/
4. http://epaperpress.com/lexandyacc/

22CSC51

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to

1. Make use of Data sets in implementing the machine learning algorithms.
2. Implement the machine learning concepts and algorithms in any suitable language of choice.
3. Make use of real world data to implement machine learning models.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Identify core challenges in machine learning such as data handling, model selection, and complexity.
2. Utilize modern tools like Python libraries, TensorFlow, and Keras for data analysis and ML implementation.
3. Apply appropriate model parameters and machine learning techniques to solve given problems.
4. Implement, test, and evaluate various machine learning algorithms using real-world datasets.
5. Design and develop ML-based solutions for real-world applications through hands-on lab experiments

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	-	-	1	1	-
CO 2	-	-	-	3	3	-	-	-	-	-	-	1	1	-
CO 3	-	3	-	3	3	-	-	-	-	-	-	1	1	-
CO 4	-	-	3	3	3	-	-	-	-	-	-	1	1	-
CO 5	-	-	3	-	3	-	-	-	3	-	-	1	1	-

1 - Slightly, 2 - Moderately, 3 – Substantially

LIST OF EXPERIMENTS:

1. Identification and Installation of python environment towards the machine learning, installing python modules/Packages Import scikitlearn, keras and tensorflows etc.
2. Implement A* algorithm on any problem.
3. Implement an 8-puzzle solver using Heuristic search technique.
4. Implement the Constraint Satisfaction problem using backtracking
5. Build linear regression model using gradient descent, least squares and polynomial approaches also compare all the algorithms and draw a table for all the metrics.
6. Demonstration of Logistic Regression for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
7. Demonstration of Naïve Bayesian classifier for a sample training data set stored as a .CSV file. Calculate the accuracy, precision, and recall for your dataset.
8. Build the decision tree classifier compare its performance with ensemble techniques like random forest, bagging, boosting and stacking.
9. Demonstration of SVM and use for character recognition task.
10. Demonstration of Kmeans and DBSCAN Clustering algorithms

TEXT BOOKS:

1. Russell, Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Education, 2nd Ed., 2015.
2. Giuseppe Bonaccorso, “Machine Learning Algorithms”, 2nd Edition, Packt, 2018

SUGGESTED READING:

1. Tom M. Mitchell, "Machine Learning", McGraw Hill, 4th Ed., 2017.
2. Rich, Knight, Nair, "Artificial Intelligence", Tata McGraw Hill, 3rd Ed., 2017.
3. Puneet Mathur, "Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance", 1st Ed., Apress, 2019.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Ed., CRC Press, 2014.
5. Saroj Kaushik, "Artificial Intelligence", 1st Ed., Cengage Learning India, 2011.

22CSC26N

MINI PROJECT

Instruction	3 Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1.5

Objective:
The main objective of this mini project is to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. It enables the students to design and develop solutions to real world problems by applying programming knowledge to become a good engineer. It acts like a beginners guide to do larger projects later in their career.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Identify and understand the real world problems.
2. Design and represent the solutions by using various design aids/charts/diagrams.
3. Implement the solutions using modern tools/languages.
4. Analyze and interpret the experimentation results, draw conclusions.
5. Communicate effectively through technical reports and presentation according to the documentation/report guidelines.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	3	2	-	-	1	-	-	2	-	-	2	3	-
CO 2	3	3	2	2	3	-	-	-	-	-	-	-	-	-
CO 3	2	2	2	1	3	-	-	-	-	-	-	2	2	-
CO 4	2	3	2	3	3	1	-	2	2	-	2	-	-	-
CO 5	1	1	1	-	3	-	-	1	2	2	2	-	-	-

1 - Slightly, 2 - Moderately, 3 – Substantially

SOME OF THE GUIDELINES FOR MINI PROJECT:

1. **Selection of Topic**: Students may be encouraged to choose a project to solve real world problems in the domain of Computer science or a multidisciplinary. Those projects shall have value addition helping the students to enhance their technical and managerial skills.
2. **Requirements Gathering:** Student shall gather the requirements and then analysis followed by a detailed study on the existing solutions.
3. **Design:** For the chosen problem, students shall formulate the solution and represent with suitable diagrams (Flowchart/Algorithm/UML) by making use of modern tools.
4. **Implementation:** The proposed design has to be implemented using suitable technologies/languages/models to provide an efficient solution.
5. **Evaluation and investigation:** Students shall interpret and evaluate the results of the experimentation. Shall work towards building products/working models/prototypes.
6. **Presentation:** one should be able to present the results in proper way. So it should be prepared in such a way that, it reflects the exact objective their Mini Project.

INSTRUCTIONS:

1. A group of 2 to 3 students can choose a project.
2. Choose a project title in consultation of their supervisor or mentor.
3. The project topic topic/problem should be related to the fields of Computer Science or Multidisciplinary courses studied earlier or current semester.
4. Each group must prepare a title of the mini project.
5. Submit an early proposal (1-2 pages of abstract) by the end of **Fourth Week**.

6. Report must be submitted during the project presentation (**14th Week**).
7. The progress of the mini project is monitored by the mentor and coordinator **every week**. Each student has to maintain a **project diary** duly signed by the mentor.

Guidelines for awarding CIE (Max. Marks: 50)		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Mini-project Coordinator and Mentor	20	Project Status / Progress
	5	Report
	5	Methodology
	10	Slide Preparation & Presentation with demo
	5	Question and Answers
	5	Submission of Report

22CSU02

UP SKILL CERTIFICATION COURSE-II / MOOCS / NPTEL

Instruction	-
Duration of SEE	-
SEE	-
CIE	25 Marks
Credits	0.5

The All India Council for Technical Education (AICTE) has established a comprehensive **Internship Policy** to enhance the employability and practical skills of students enrolled in technical education programs. This policy outlines the structure, objectives, and implementation guidelines for internships.

COURSE OBJECTIVES: This course aims to

1. Provide students with real-world industrial experience that complements academic learning.
2. Develop technical and managerial skills relevant to the student's field of study.
3. Foster professional attitudes, ethics, and communication skills.
4. Increase job readiness by bridging the gap between theoretical knowledge and practical application.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Apply academic knowledge and technical skills in a real-world industrial or organizational setting.
2. Demonstrate effective communication, teamwork, and problem-solving abilities in a professional environment.
3. Understand the structure, culture, and operational procedures of the Industry.
4. Develop and present professional reports and documentation based on internship experiences.
5. Exhibit on career goals and improve employability through hands-on experience and mentorship.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	3	2	2	1	1	2	2	1	2	3	2	3
CO 2	1	3	2	2	2	1	2	3	3	2	2	3	2	3
CO 3	2	1	1	1	2	2	2	2	2	1	2	3	2	2
CO 4	2	2	1	1	1	1	2	3	3	1	2	3	2	3
CO 5	1	2	2	1	2	2	2	2	2	1	3	2	1	3

1 - Slightly, 2 - Moderately, 3 – Substantially

Roles and Responsibilities:

- **Institutions**: Establish Training and Placement Cells to facilitate internship placements and maintain industry relations.
- **Students**: Proactively seek internship opportunities, maintain a daily logbook, and submit a comprehensive report upon completion.
- **Industry Partners**: Provide meaningful work assignments, mentorship, and evaluate student performance

Evaluation and Certification:

- **Assessment**: Student performance is evaluated based on reports, presentations, and feedback from industry mentors.
- **Certification**: Upon successful completion, students receive certificates from the host organization, which are considered during academic evaluations.

References:

1. **AICTE Internship Portal**: Students can explore and apply for internships through the AICTE Internship Portal. https://internship.aicte-india.org/
2. **AICTE Internship Policy Document**: Detailed guidelines and procedures can be found in the official. https://aicte-india.org/sites/default/files/AICTE%20Internship%20Policy.pdf

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION
(Inline with AICTE Model Curriculum with effect from AY 2027-28)
(R22A Regulation)

SEMESTER – VII

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22CSC54	Deep Learning for Computer Vision	3	-	-	3	40	60	3
2.	22CSC56	Network Security	4	-	-	3	40	60	4
3.	22EEM01	Universal Human Values-II: Understanding Harmony	-	1	-	-	50	-	1
4.	22CSExx	Professional Elective Course –IV	3	-	-	3	40	60	3
5.	22CSExx	Professional Elective Course -V	3	-	-	3	40	60	3
6.	22xxxxx	Open Elective Course-II	3	-	-	3	40	60	3
PRACTICAL									
7.	22CSC57	Network Security Lab	-	-	3	3	50	50	1.5
8.	22CSExx	Professional Elective - V Lab	-	-	3	3	50	50	1.5
9.	22CSC38N	Technical Seminar	-	-	2	-	50	-	1
10.	22CSC37N	Project Part-I	-	-	4	-	50	-	2
TOTAL			**16**	**1**	**12**	**-**	**450**	**400**	**23**
Clock Hours Per Week: 29									

L L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

Professional Elective-IV	
22CSE23	Robotic Process Automation
22CSE25	Cloud Computing Essentials
22CSE32	Cyber Security
22CAE08N	Reinforcement Learning
22ADE76N	Generative AI

Open Elective - II	
22EEO01	Energy Management System
22EGO01	Technical Writing Skills
22CAO02	Ethical Intelligence
22MEO06	Principles of Entrepreneurship and Startups
22BTO04	Bioinformatics

Professional Elective-V	
22CSE15N	Software Testing
22CSE26	Applied Natural Language Processing
22CSE28	Full Stack Development
22CSE30	Internet of Things
22ITE11	Devops Tools

Professional Elective -V Lab	
22CSE16N	Software Testing Lab
22CSE27	Applied Natural Language Processing Lab
22CSE29	Full Stack Development Lab
22CSE31	Internet of Things Lab
22ITE12	Devops Tools Lab

22CSC54

DEEP LEARNING FOR COMPUTER VISION

Instruction	3 Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Artificial intelligence, Machine Learning

COURSE OBJECTIVES: This course aims to

1. Learn the fundamentals of deep learning and the main research activities in this field.
2. Acquire the knowledge of Deep learning methods, models, Optimizations, Regularizations and algorithms.
3. Understand CNN, RNN, Transformers and GANs along with their applications.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand various optimization techniques used in deep learning.
2. Analyze various Autoencoders and Regularization Techniques.
3. Design and Develop various Convolution Neural Networks architectures.
4. Analyze various RNNs and Encoder Decoder Models.
5. Understand the importance of Transformers and GANs to develop real-time applications.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	2	2	-	-	-	-	-	-	1	1	-
CO 2	-	1	1	1	-	-	-	-	-	-	-	1	1	-
CO 3	2	1	1	1	-	-	-	-	-	-	-	1	1	-
CO 4	1	1	1	1	-	-	-	-	-	-	-	1	1	-
CO 5	-	1	1	1	-	-	-	-	-	-	-	1	1	-

UNIT - I

Introduction: Feedforward Neural Networks, Representation Power of Feedforward Neural Networks, Backpropagation, Historical Trends in Deep Learning. **Optimization**: Challenges in Neural Network Optimization, Gradient Descent (GD), Stochastic GD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, RMSProp, Adam.

UNIT - II

Autoencoders: relation to PCA, Regularization in autoencoders, Denoising autoencoders, Sparse autoencoders, Contractive autoencoders, **Regularization:** Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization

UNIT - III

Convolutional Neural Network: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types. LeNet, AlexNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Backpropagation, Deep Dream, Deep Art.

UNIT – IV

Recurrent Neural Networks, Backpropagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs Encoder Decoder Models, Attention Mechanism, Attention over images

UNIT – V

Transformers: Introduction to Transformers, BERT, Vision Transformers. **Generative Adversarial Networks (GANs):** Introduction, Discriminator, Generator, Activation functions for GANs, BCE loss, Conditional GANs, Controllable generation, real life GANs.

TEXT BOOKS:

1. Goodfellow. I., Bengio. Y. and Courville. A., "Deep Learning ", MIT Press, 2016.
2. Rothman, Denis, "Transformers for Natural Language Processing: Build innovative deep neural network architectures for NLP with Python, PyTorch, TensorFlow, BERT, RoBERTa, and more", Packt Publishing Ltd, 2021.

SUGGESTED READING:

1. Ganguly Kuntal, "Learning generative adversarial networks: next-generation deep learning simplified", Packt Publishing, 2017.
2. Zhang, Aston, Zachary C. Lipton, Mu Li, and Alexander J. Smola. "Dive into deep learning", Cambridge University Press, 2023.
3. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc18_cs41/
2. https://onlinecourses.nptel.ac.in/noc22_cs22/
3. https://onlinecourses.nptel.ac.in/noc19_cs85/

22CSC56

NETWORK SECURITY

Instruction	4 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

PREREQUISITE: Data Communication and computer networks.

COURSE OBJECTIVES: This course aims to
1. Understand the importance of confidentiality, integrity, availability and authentication.
2. Understand various cryptographic algorithms.
3. Understand Hashing techniques.
4. Describe key management and distribution and application security schemes.
5. Understand implementation of Transport layer and web security

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Recall the security principles, attacks, services and mechanisms.
2. Identify classical encryption techniques and block ciphers.
3. Apply hash and MAC algorithms, and digital signatures.
4. Analyze and evaluate key management and application security schemes like PGP, S/MIME.
5. Create IP security, SSL/TLS, and case studies.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	1	1	1	-	-	-	-	-	2	1	1	-
CO 2	3	2	2	2	1	-	-	-	-	-	1	1	1	-
CO 3	2	2	2	2	1	-	-	-	-	-	1	1	2	-
CO 4	1	1	1	2	1	-	-	-	-	-	2	1	2	-
CO 5	1	3	3	1	2	-	-	-	-	-	1	1	2	-

UNIT-I

Security Concepts: Introduction, Information Security Policy, Standards, and Practices; Types of Security attacks, Security services, Security Mechanisms, A model for Network Security. **Cryptography Concepts and Techniques**: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography

UNIT-II

Symmetric key Ciphers: Block Cipher principles, DES, AES, Blowfish, Block cipher operation, Stream ciphers, RC4. **Asymmetric key Ciphers:** Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange.

UNIT-III

Cyptographic Hash Functions: Message Authentication, Secure Hash Algorithm (SHA-512). **Message authentication codes:** Authentication requirements, HMAC, Digital signatures, Elgamal Digital Signature Scheme.

UNIT–IV

Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure. **E-Mail Security:** Pretty Good Privacy, S/MIME.

UNIT–V

IP Security: IP Security overview, IP Security architecture, Authentication Header, Encapsulating security payload. **Transport-level Security:** Web security considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH). **Case Studies:** Secure Multiparty Calculation, Single sign On. **Advanced Topics:** Introduction to Quantum Cryptography, Security Models and Analysis.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security - Principles and Practice", 7th Edition, Pearson Education,
2. Atul Kahate, "Cryptography and Network Security", 3rd Edition, Mc Graw Hill,

SUGGESTED READING:

1. Michael E. Whitman and Herbert J. Mattord , "Principles of Information Security", 4th Edition., Cengage Learning.
2. C K Shyamala, N Harini, Dr T R Padmanabhan, "Cryptography and Network Security", 1st Edition, Wiley India,
3. Forouzan Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Mc Graw Hill.
4. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
5. WM. Arthur Conklin, Greg White, "Principles of Computer Security", TMH.
6. Neal Krawetz, "Introduction to Network Security", CENGAGE Learning.
7. Bernard Menezes, "Network Security and Cryptography", CENGAGE Learning.

ONLINE RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_cs16/

22EEM01

UNIVERSAL HUMAN VALUES-II: UNDERSTANDING HARMONY

(B.E/B. Tech - Common to all Branches)

Instruction	1 T Hours per Week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

Introduction:
This course discusses the role of human values in one's family, in society and in nature. During the Induction Program, students would get an initial exposure to human values through Universal Human Values–I. This exposure is to be augmented by this compulsory full semester foundation course.

COURSE OBJECTIVES: This course aims to
1. Understand the concept of universal human values
2. Cultivate empathy and respect for diversity
3. Inspire the social responsibility and global citizenship

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Become familiar about themselves, and their surroundings (family, society, nature).
2. Develop empathy and respect for diversity by gaining an appreciation for different cultures, perspectives, and identities
3. Exhibit responsible and ethical behavior by adhering to principles of integrity, honesty, compassion, and justice.
4. Recognize their role as global citizens.
5. Exhibit a sense of social responsibility.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	-	1	-	-	1	-	1	-	-	1			
CO 2	-	-	1	-	-	1	-	1	-	1	1			
CO 3	--	-	-	-	-	1	-	-	1	-	-			
CO 4	-	-	-	-	-	1	1	-	-	-	-			
CO 5	-	-	-	-	-	1	1	-	-	-	-			

MODULE -1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values-I
- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and
- Experiential Validation- as the process for self-exploration.
- Natural acceptance of human values.
- Definitiveness of Ethical Human Conduct.
- Continuous Happiness and Prosperity- A look at basic Human Aspirations.
- Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current Scenario.
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

MODULE- 2: Understanding Harmony in the Human Being - Harmony in Myself

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

MODULE-3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
- Understanding the meaning of Trust; Difference between intention and competence.
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
- Understanding the harmony in society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co -existence as comprehensive Human Goals.
- Strategy for transition from the present state to Universal Human Order:
  a. At the level of individual: as socially and ecologically responsible engineers, technologists, and managers.
  b. At the level of society: as mutually enriching institutions and organizations.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives.

MODULE -4: Understanding Harmony in Nature and Existence - Whole existence as Coexistence.

- Understanding the harmony in Nature.
- Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature.
- Understanding Existence as Co-existence of mutually interacting units in all - pervasive space.
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
- Holistic perception of harmony at all levels of existence.
- Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability Identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability Identify and develop appropriate technologies and management patterns for above production systems.
- Case studies of typical holistic technologies, management models and production systems.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc.

MODE OF CONDUCT (L-T-P-C 0-1-0-0)

- While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

- In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection, and self-exploration.
- Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentors, in a group sitting.
- **Tutorials (experiments or practical) are important for this course**. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignments and/or activities are included.
- The practice sessions would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to the development of commitment, namely behaving and working based on basic human values.
- **It is advised to share the experience of the Faculty to the class in a capsule form.**
- **Involve more in evaluating the student by different activities with proper RUBRCCS**

Assessment:
This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self- assessment, peer assessment etc. will be used in evaluation.

Example:

Module-1:	10 M
Module -2:	10 M
Module- 3:	10 M
Module-4:	10 M
Attendance & Attitude:	10 M

The overall pass percentage is 50%. In case the student fails, he/she must repeat the course.

TEXT BOOKS:

1. R. R. Gaur, R. Asthana, and G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics," 2nd revised ed., Excel Books, New Delhi, 2022.
2. R. R. Gaur, R. Asthana, and G. P. Bagaria, "Teacher's Manual for A Foundation Course in Human Values and Professional Ethics," 2nd revised ed., Excel Books, New Delhi, 2022.

SUGGESTED READING:

1. A. Nagaraj, "Jeevan Vidya: Ek Parichaya," Jeevan Vidya Prakashan, Amarkantak, 1999.
2. A. N. Tripathi, "Human Values," New Age Intl. Publishers, New Delhi, 2004.
3. "The Story of Stuff," (Book).
4. M. K. Gandhi, "The Story of My Experiments with Truth."

22CSE23

ROBOTIC PROCESS AUTOMATION

(Professional Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Provide insights on robotic process automation (RPA) technology and its value proposition
2. Introduce different platforms for RPA
3. Learn different types of variables, control flow and data manipulation techniques
4. Familiarize with Image, Text and data Tables Automation
5. Describe various types of Exceptions and strategies to handle them.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Gain insights into Robotic Process Automation Technology
2. Acquire knowledge of RPA Platforms and components
3. Identify and understand Image, Text and Data Tables Automation
4. Understand various control techniques and OCR in RPA
5. Describe Exception Handling and Debugging techniques

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	-	-	-	-	-	-	1	2	-
CO 2	2	1	1	-	2	-	-	-	1	2	-	1	1	-
CO 3	2	1	1	2	2	-	-	-	1	1	-	1	1	-
CO 4	2	1	1	1	2	-	-	-	1	-	-	1	2	3
CO 5	2	1	-	1	1	-	-	-	-	-	-	2	2	2

UNIT– I

RPA Foundations- What is RPA - flavors of RPA- history of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA - Consumer Willingness for Automation- The Workforce of the Future- RPA Skills- On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code OCR-Databases-APls- Al- Cognitive Automation-Agile, Scrum, Kanban and Waterfall Devops Flowcharts.

UNIT–II

RPA Platforms- Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and PIay - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step by step examples using the recorder.

UNIT–III

Sequence, Flowchart, and Control Flow-sequencing the workflow- Activities-Control flow, various types of loops, and decision making-Step-by step example using Sequence and Flowchart-Step-by-step example using Sequence and Control Flow-Data Manipulation-Variables and Scope Collections-Arguments – Purpose and useData table usage with examples Clipboard Management-File operation with step-by-step exampleCSV/Excel to data table and vice versa [with a step-by-step example).

UNIT–IV

Handling Events -Taking Control of the Controls- Finding and attaching windows- Finding the 08 controlTechniques for waiting for a control- Act on controls - mouse and keyboard activities- Working with Ui Explorer- Handling eventsRevisit recorder- Screen Scraping- When to use OCR- Types of OCR availableHow to use OCR- Avoiding typical failure points.

UNIT–V

Exception Handling, Debugging, and Logging- Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots Debugging techniques- Collecting crash dumps- Error reporting, Industry Use case, Future of RPA.

TEXT BOOKS:

1. T. Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems," Apress Publishing, 2020.
2. A. M. Tripathi, "Learning Robotic Process Automation," Packt Publishing, 2018.

SUGGESTED READING:

1. R. Murdoch, "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant," Independently Published, 1st ed., 2018.
2. F. Casale, R. Dilla, H. Jaynes, and L. Livingston, "Introduction to Robotic Process Automation: A Primer," Institute of Robotic Process Automation, 1st ed., 2015.
3. S. Merianda, "Robotic Process Automation Tools, Process Automation and Their Benefits: Understanding RPA and Intelligent Automation," Consulting Opportunity Holdings LLC, 1st ed., 2018.

ONLINE RESOURCES:

1. https://www.uipath.com/rpa/robotic-process-automation
2. https://www.academy.uipath.com

22CSE25

CLOUD COMPUTING ESSENTIALS

(Professional Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Data communication and computer networks.

COURSE OBJECTIVES: This course aims to

1. Understand the significance of cloud computing services.
2. Understand the cloud infrastructure and Technologies.
3. Learn the security implementation features in cloud computing.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the need of cloud technology and terminology.
2. Identify and understand the cloud infrastructure.
3. To understand and apply various virtualization concepts.
4. Design solutions for the automation and migration of manual data centers.
5. Analyze the Cloud Security and privacy issues.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	1	1	-	-	-	1	-	-	1	1	-
CO 2	2	1	-	1	1	-	-	-	-	1	1	1	1	-
CO 3	2	1	-	1	1	1	-	-	-	-	-	1	1	2
CO 4	2	2	2	1	1	1	-	-	1	1	-	-	1	3
CO 5	2	2	-	1	1	1	-	-	-	2	1	1	1	2

UNIT - I

Era of Cloud Computing – Motivation, Elastic Computing and advantages- Multi-Tenant clouds, Elastic computing, Virtualized servers uses, Business model for Cloud Providers. Types of Clouds and Cloud Providers,Multi-Cloud, Hyperscalers, advantages of clouds;

UNIT - II

Virtualization and Containers -Virtual machines, hypervisor, approaches to virtualization, advantages and disadvantages of VMs, Virtual I/O devices, VM migration; Traditional apps and elasticity on demand, isolation facilities in an OS, Docker containers, Docker Terminology and Development tools.

UNIT - III

Virtual Networks – Goals of a data center network, Network hierarchies, capacity, Fat Tree Designs. Link aggregation, VLANS, VXLAN, NAT, Managing virtualization and mobility, SDNs, openflow protocol, Programming networks; **Virtual Storage**: NAS, SAS, mapping virtual disks to physical disks.

UNIT - IV

Automation and Cloud Programming - Need of automation, levels, AIops, automation tools, automation of manual data center practices, evolution of automation; **Orchestration:** legacy of automating procedures, larger scope of automation, Kubernetes MapReduce, Microservices, Serverless computing, event processing, DevOps, Edge Computing and IIoT.

UNIT - V

Cloud security and Privacy – cloud specific problems, zero trust security model, identity management, privileged access management(PAM), AI technologies and their effects on their security, Protection of remote access and privacy in a cloud environment, back doors, side channels and other concerns,firewalls

TEXT BOOKS:

1. Douglas Comer, "The Cloud Computing Book: The Future of Computing Explained", A Chapman andHall/CRC, 1st Edition Kindle Edition, 2021.
2. Anthony T Velte, Toby J, Robert Elenpeter, "Cloud Computing – A Practical Approach", McGra Hill,2010.

ONLINE RESOURCES:

1. https://www.amazon.in/Cloud-Computing-Book-Future-Explained/dp/0367706806?asin=B097N7NKJD&revisionId=&format=4&depth=1

22CSE32

CYBER SECURITY
(Professional Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Operating Systems, Data communications and computer networks, Cryptography and network security.

COURSE OBJECTIVES: This course aims to
1. Identify and understand methods and tools used in cybercrimes.
2. Collect, process, analyze and present Computer Forensics Evidence.
3. Understand the legal perspectives and organizational implications of cyber security.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. List the different types of cybercrimes and analyze legal frameworks to handle cybercrimes.
2. Discuss the cyber offence and vulnerabilities in programming languages.
3. Identify the Tools and Methods used in cybercrimes.
4. Analyze and resolve cyber security issues and laws governing Cyberspace.
5. Describe the need of Digital Forensics and the importance of digital evidence in prosecution.
6. Interpret the commercial activities in the event of significant information security incidents in the Organization.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	-	-	-	-	-	-	-			
CO 2	3	3	2	-	-	-	-	-	-	-	-			
CO 3	2	2	2	-	-	-	-	-	-	-	-			
CO 4	2	2	1	-	-	-	-	-	-	-	-			
CO 5	2	2	1	-	-	-	-	-	-	-	-			
CO 6	2	3	1	-	-	-	-	-	-	-	-			

UNIT-I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cybercrime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Buffer Overflow, How Browsers Work, Google Dorking, Scanning the Entire Internet: Masscan and Shodan. **Building Secure Software:** Memory corruption attack, Vulnerability in programming language, Virtual memory layout of C Program, Buffer overflow attack in C and C++, Pointer attacks, Heap Overflow, Integer Overflow.

UNIT - III

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, Injection Attacks, SQL Injection,

Ransomware, Cross-Site Scripting Attacks, ARP Spoofing Attacks, SYN Floods and detecting SYN Scans.

UNIT – IV

Cyber Security: The Legal Perspectives**:** Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Amendments to IT Act, Positive and week areas of IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Data Protection Act 2019.

UNIT – V

Understanding Cyber Forensics: Introduction, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Challenges in Computer Forensics. **Cyber Security: Organizational Implications:** Introduction, Cost of Cybercrimes and IPR issues, Software Piracy, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOKS:

1. Sunit Belpre and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd, 2011.
2. Malcolm McDonald "Web Security for Developers," Starch Press, June 2020.
3. Daniel G. Graham "Ethical Hacking: A Hands-on Introduction to Breaking in" Starch Press, 2021.
4. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGraw Hill, 2006.

SUGGESTED READING:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, "Cyber Security and Cyber Laws", Paperback, 2018.
2. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge university press, 2006.

ONLINE RESOURCES:

1. https://onlinecourses.swayam2.ac.in/nou19_cs08/preview
2. https://onlinecourses.swayam2.ac.in/cec20_cs15/preview

22CAE08N

REINFORCEMENT LEARNING
(Professional Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Probability and Statistics, Machine Learning, Data Structures.

COURSE OBJECTIVES: This course aims to
1. Understand the fundamental principles of Reinforcement Learning and MDP Process.
2. Analyze Monte Carlo Methods and Temporal-Difference learning techniques.
3. Evaluate the use of Eligibility Traces in reinforcement learning through case studies.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Acquire the fundamental concepts of Reinforcement Learning.
2. Apply the concepts of Finite Markov Decision Process to solve the complex problems.
3. Analyze and evaluate the effectiveness of Monte Carlo methods and on/Off Policy methods
4. Analyze and apply Temporal Difference Learning for real world problems.
5. Evaluate eligibility traces and novel reinforcement learning solutions.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	-	-	-	-	-	-	-	-	1			
CO 2	3	3	2	2	-	-	-	-	-	-	1			
CO 3	3	3	2	3	2	-	-	2	-	-	1			
CO 4	3	3	3	3	2	-	2	3	-	-	2			
CO 5	3	2	3	3	2	-	2	3	-	-	2			

UNIT-I

Introduction to Reinforcement Learning: -Examples, History of RL, Limitations, Scope, Elements of Reinforcement Learning, An n-armed bandit problem, Action-value methods, Incremental Implementation, Tracking a nonstationary problem, Optimistic initial values, Upper- Confidence-Bound Action Selection, Gradient bandits.

UNIT-II

Finite Markov Decision Processes: The Agent-Environment Interface, Goals and Rewards, Returns, Unified Notation for Episodic and Continuing Tasks, The Markov Property, Markov Decision Processes, Value Functions, Optimal Value Functions, Optimality and Approximation.

UNIT-III

Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off- Policy prediction via importance sampling, Incremental implementation, Off-policy monte carlo control.

UNIT-IV

Temporal-Difference learning: TD prediction, Advantages of TD prediction methods, Optimality of TD(0), Sarsa: On-policy TD control, Q-Learning: Off-policy TD control.

UNIT-V

Eligibility Traces: n-step TD prediction, The forward view of TD(λ),the backward view of TD(λ), Equivalences of forward and backward views, Sarsa(λ), Watkin's Q(λ), Off-policy eligibility traces using importance sampling.**Case studies:** TD-Gammon, Samuel's Checkers Player.

TEXT BOOKS:

1. R. S. Sutton and A. G. Barto, "Reinforcement Learning: An Introduction," 1st ed., MIT Press, 2020.
2. M. Sugiyama, "Statistical Reinforcement Learning: Modern Machine Learning Approaches," 1st ed., CRC Press, 2015.

SUGGESTED READING:

1. T. Lattimore and C. Szepesvári, "Bandit Algorithms," 1st ed., Cambridge University Press, 2020.
2. B. Belousov, H. Abdulsamad, P. Klink, S. Parisi, and J. Peters, "Reinforcement Learning Algorithms: Analysis and Applications," 1st ed., Springer, 2021.
3. A. Zai and B. Brown, "Deep Reinforcement Learning in Action," 1st ed., Manning Publications, 2020.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106106143
2. https://www.coursera.org/specializations/reinforcement-learning

22ADE76N

GENERATIVE AI
(Professional Elective-IV)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Python Programming, Deep Learning

COURSE OBJECTIVES: This course aims to
1. Introduce the fundamentals of generative modeling and deep learning.
2. Explore key architectures including VAEs, GANs, and Diffusion Models.
3. Apply TensorFlow/Keras to build generative models
4. Understand applications of generative AI in text, image, music, and multimodal domains.
5. Examine current and future trends in generative AI and its real-world impact.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand foundational concepts of generative modelling, probability theory, and Variational Autoencoders.
2. Analyze and implement various GAN architectures for generating synthetic data and images.
3. Explore and evaluate diffusion models including training, sampling, and analysis processes.
4. Apply transformer-based architectures for language modelling and fine-tune encoder/decoder models.
5. Develop effective prompting strategies to control and enhance outputs from generative language models.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	-	-	-	-	-	-	-	2	1	3
CO 2	2	3	2	3	3	-	-	-	-	-	-	3	1	3
CO 3	2	3	2	3	3	-	-	-	-	-	-	2	1	3
CO 4	2	3	2	3	3	-	-	-	-	-	-	2	1	3
CO 5	1	2	2	3	3	-	-	-	-	-	-	2	1	3

UNIT-I

Generative Modelling: What is Generative Modelling, Generative vs. Discriminative Models, The Rise of Generative Modelling, Generative Modelling Framework, **Core Probability Theory**: Sample Space, Probability Density Function, Parametric Modeling, Likelihood, Maximum Likelihood Estimation, **Variational Autoencoder**: Architecture, Exploring the Latent Space,

UNIT-II

Generative Adversarial network : Introduction, Deep Convolution GAN, Wasserstein GAN with Gradient Penalty (WGAN-GP), Conditional GAN (CGAN), **Advanced GAN**: Progressive GAN, StyleGAN, StyleGAN2

UNIT-III

Diffusion Models: Introduction, Denoising Diffusion Models (DDM) and its process, Diffusion Schedules, The Reverse Diffusion Process,The U-Net Denoising Model- Training, Sampling and Analysis, Stable Diffusion, DALL.E 2- Architecture, training Process, GLIDE, ImageGen

UNIT-IV

Transformers: Introduction, Architecture- Attention, Multi head Attention, Masking, Transformer Block, Encoder Based only Transformers Architectures and Fine Tuning : BERT, **Generative LLMs**: Introduction to LLMs, Decoder-only Transformers, Training LLMs, Fine-tuning LLMs, Introduction to various LLM: GPT, Falcon, LLaMA2

UNIT-V

Prompt Engineering: Introduction, Prompt Engineering Strategies, **Advanced Prompting Methods**: Chain of Thought, Problem Decomposition, Self-refinement, Ensembling, RAG and Tool Use, **Learning to Prompt:** Prompt Optimization,Soft Prompts

TEXT BOOKS:

1. D. Foster, "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play," 2nd ed., O'Reilly Media, 2023.
2. T. Xiao and J. Zhu, "Foundations of Large Language Models," arXiv:2501.09223 [cs.CL], January 16, 2025.

SUGGESTED READING:

1. J. Babcock and R. Bali, "Generative AI with Python and TensorFlow 2," Packt Publishing Ltd., UK, 2021.

ONLINE RESOURCES:

1. https://paperswithcode.com
2. https://huggingface.co/
3. https://arxiv.org/pdf/2501.09223

22CSE15N

SOFTWARE TESTING
(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Software Engineering

COURSE OBJECTIVES: This course aims to
1. Learn various software testing methodologies and techniques.
2. Develop the skills to design and execute comprehensive test plans.
3. Analyze and interpret test results to improve software quality.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Analyze various test processes and continuous quality improvement.
2. Analyze Types of errors and fault models
3. Modeling the behavior using FSM
4. Application of software testing techniques in commercial environments
5. Analyze various test tools

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	1	2	1	1	1	1	1	2	2	1	3	2
CO 2	2	3	3	2	3	2	2	1	1	1	-	-	3	2
CO 3	2	-	2	2	3	-	-	1	1	1	-	-	3	2
CO 4	2	1	1	1	2	2	-	1	1	2	1	1	3	2
CO 5	2	1	1	1	1	-	-	-	-	1	-	1	3	2

UNIT - I

Introduction to Software Testing: Introduction, Evolution of Software Testing, Software Testing—Myths and Facts, Goals of Software Testing, Psychology for Software Testing, Software Testing Definitions, Model for Software Testing, Effective Software Testing vs. Exhaustive Software Testing, Effective Testing is Hard, Software Testing as a Process, Schools of Software Testing, Software Failure Case Studies

UNIT - II

Dynamic Testing: Black-Box Testing Techniques, Boundary Value Analysis (BVA), Equivalence Class Testing, State Table-Based Testing, Decision Table-Based Testing, Cause-Effect Graphing Based Testing, Error Guessing, Orthogonal Array Testing

UNIT - III

White-Box-Testing, Data Flow Testing, Mutation Testing,Static Testing, Inspections, Structured Walkthroughs, Technical Reviews, Validation Activites , Unit Validation Testing, Integration Testing, Function Testing, System Testing, Acceptance Testing , Security Testing

UNIT - IV

Regression Testing, Progressive vs. Regressive Testing, Regression Testing Produces Quality Software, Regression Testability, Objectives of Regression Testing, when is Regression Testing Done? Regression Testing Types, Defining Regression Test Problem, Regression Testing Techniques

UNIT - V

Test Management, Test Organization, Structure of Testing Group, Test Planning, Detailed Test Design and Test Specifications, Efficient Test Suite Management, Why Does a Test Suite Grow?, Minimizing the Test Suite and its Benefits, Defining Test Suite Minimization Problem, Test Suite Prioritization, Types of Test Case Prioritization, Prioritization Techniques, Measuring the Effectiveness of a Prioritized Test Suite

TEXT BOOKS:

1. Naresh Chauhan, “Software Testing- Principles and practices ”, Oxford University Press, Second Edition, 2016
2. Jamie L. Mitchell and Rex Black, “Advanced Software Testing” Vol. 3, Second Edition, 2015

SUGGESTED READING:

1. B. Marick, "The Craft of Software Testing," Pearson Education, 2012
2. "Software Testing Techniques," SPD (O’Reilly), 2002.
3. E. Kit, "Software Testing in the Real World," Pearson, 2011.
4. "Effective Methods of Software Testing," J. Perry, John Wiley, 2006.
5. "Art of Software Testing," J. Myers, John Wiley, 2011.

ONLINE RESOURCES:

1. NPTEL:: Computer Science and Engineering - NOC:Software testing
2. Udemy:Software Testing – Beginner to Advanced Online Courses

22CSE26

APPLIED NATURAL LANGUAGE PROCESSING

(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Artificial Intelligence, Machine Learning

COURSE OBJECTIVES: This course aims to

1. Learn the fundamentals of natural language processing.
2. Understand the various text processing techniques in NLP.
3. Understand the role Text Classification Deep Learning for Text Classification techniques of NLP
4. Use Topic Modelling, Case Studies and apply the NLP techniques to IR applications.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the fundamental concepts of the Natural Language Processing (NLP) pipeline and its real-world applications.
2. Illustrate and compare various text representation techniques used in NLP, including traditional and modern embeddings.
3. Apply and analyze text classification techniques and basic deep learning models for natural language tasks.
4. Evaluate different text summarization methods and examine example systems for effective information distillation.
5. Design and implement NLP pipelines to solve real-world problems.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	1	-	-	-	-	-	-	-	-	-	2	1	-
CO 2	1	2	-	-	-	-	-	-	-	-	-	2	1	-
CO 3	-	-	3	2	2	-	-	-	-	-	-	1	1	-
CO 4	-	-	-	2	2	-	-	-	-	-	-	-	1	-
CO 5	-	-	1	-	-	1	-	3	3	2	-	1	1	-

UNIT - I

NLP: A Primer, NLP in the Real World, NLP Tasks, NLP Levels, What Is Language? Building Blocks of Language, Challenges in NLP, Machine Learning and Overview Approaches to NLP, Heuristics-Based, Machine Learning, Deep Learning for NLP. **NLP Pipeline:** Data Acquisition, Pre-Processing Preliminaries Frequent Steps, Advanced Processing Feature Engineering Classical NLP/ML Pipeline DL Pipeline Modeling, Evaluation of Models, Post-Modeling Phases.

UNIT - II

Text Representation: Vector Space Models Basic Vectorization Approaches, One-Hot Encoding Bag of Words, Bag of N-Grams, TF-IDF. **Distributed Representations**: Word Embedding, Going Beyond Words, Distributed Representations, Word2Vec, Glove.

UNIT - III

Traditional Text Classification Applications One Pipeline, Many Classifiers, Using Neural Embeddings in Text Classification Deep Learning for Text Classification Interpreting Text

Classification Models. **Deep Learning for Text Classification** CNNs for Text Classification, LSTMs for Text Classification

UNIT - IV

Chatbots: Applications, A Taxonomy of Chatbots, Goal-Oriented Dialog, A Pipeline for Building Dialog Systems, Deep Dive into Components of a Dialog System, Dialog Act Classification, Identifying Slots, Response Generation, Other Dialog Pipelines, End-to-End Approach, Deep Reinforcement Learning for Dialogue Generation, Rasa NLU.

UNIT - V

Real World NLP Applications: Topic Modelling, Text Summarization, Use Cases Setting Up a Summarizer: An Example Recommender Systems for Textual Data Machine Translation Question-Answering Systems, Social Media, E-Commerce and Retail, Healthcare, Finance, and Law.

TEXT BOOKS:

1. S. Vajjala, B. Majumder, A. Gupta, and H. Surana, "Practical Natural Language Processing: A Comprehensive Guide to Building Real World NLP Systems," 1st ed., O'Reilly Media, 2020.
2. J. Allen, "Natural Language Understanding," 2nd ed., Benjamin Cummings, 1995.

SUGGESTED READING:

1. T. Siddiqui and U. S. Tiwary, "Natural Language Processing and Information Retrieval," Oxford University Press, 2008.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106101007/
2. http://www.cs.colorado.edu/~martin/sp2.html
3. https://web.standford.edu/~jurafsky/sp3/

22CSE28

FULL STACK DEVELOPMENT
(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Web Programming

COURSE OBJECTIVES: This course aims to
1. Explore various features of JS and its functionality.
2. Understand the basics of mongodb and its Data Model.
3. Comprehend the new features of JS, role of React JS in responsive web application development.
4. Familiarize with configuration of NPM and backend integration with NODE JS and Express JS.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Create web pages with a good aesthetic sense of design using ES6.
2. Understand and build logical relationships between documents using MongoDB.
3. Use MongoDB concepts in Web Application Development using React JS.
4. Create real-world React web applications and related tools.
5. Build an end-to-end application from scratch using React JS, NODE JS, Express JS and Mongo DB.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	1	1	-	-	1	1	1	-	1	1	2
CO 2	1	1	1	1	2	-	-	-	-	1	1	1	1	2
CO 3	-	-	2	1	2	-	-	-	-	-	1	1	1	3
CO 4	-	-	2	1	2	-	-	-	-	-	2	-	1	3
CO 5	-	-	2	2	1	-	-	-	-	-	2	1	1	2

UNIT-I

ES6: Introduction, Variables and Scoping, Arrow Functions and Default Parameters, Template Literals and Destructuring, Spread and Rest Operators, Enhanced Object Literals, Classes and Inheritance, Promises and Async Programming, Modules in ES6, Iterators and Generators.

UNIT-II

MongoDB: Introduction, Importance of NoSQL databases, Data types, Documents, nested Documents, CRUD Operations, Basic cursor methods: map, to Array, pretty, for Each, limit, count, sort, CRUD Operations, Data Modelling & Schema Design, Indexing and Aggregation, Mongo Import/Export and Master/Slave Replication.

UNIT-III

ReactJS: Introduction, Module import and export, State, Props, Components, Lifecycle, Stateful and stateless components, Events, Router, Forms, Tables, Portals, CSS, Hooks.

UNIT-IV

NodeJS: Creating Web Server, Functions, Buffer, Node Modules, Creating Web Server, Handling HTTP requests File System: Operations on file and Other I/O Operations. Events: Event Emitter class, Inheriting Events and Returning event emitter.

UNIT-V

Express JS: API methods - GET, POST, PUT, DELETE, Request & response objects, URL and Query parameters, Routing, The model-view-controller pattern, Middleware. Templates: EJS, PUG

TEXT BOOKS:

1. Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", second Edition, Apress Publications, 2019.
2. David Hows, Peter Membrey, EelcoPlugge – "MongoDB Basics", Apress, 2014.

.

SUGGESTED READING:

1. Ethan Brown, "Web Development with Node and Express", Oreilly Publishers, First Edition, 2014.
2. Shelly Powers, "Learning Node: Moving to the Server-Side", 2nd Edition, O"REILLY, 2016.
3. Simon D. Holmes and Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Second Edition, Manning Publications, 2019
4. Brad Dayley, "Node.js, MongoDB and Angular Web Development", 2nd Edition, Addison-Wesley Professional, 2017.

ONLINE RESOURCES:

1. https://web.stanford.edu/class/cs142/index.html
2. https://nodejs.org/en/docs/
3. https://www.mongodb.com/
4. https://reactjs.org/

22CSE30

INTERNET OF THINGS
(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Computer Architecture and Micro Processor, Programming for Problem Solving.

COURSE OBJECTIVES: This course aims to
1. Understand the individual components of IoT.
2. Impart necessary and practical knowledge in Internet of Things.
3. Develop skills required to build real-time IoT based projects

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand Internet of Things and its basics components.
2. Illustrate working of I/O devices, sensors & communication module.
3. Analyse the use of protocols in IoT.
4. Illustrate unstructured data storage
5. Develop real time IoT based projects.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	1	-	-	-	-	-	-	1	3	-
CO 2	1	-	-	-	1	-	-	-	-	-	-	1	2	-
CO 3	1	2	-	-	1	-	-	-	-	-	-	1	2	-
CO 4	1	-	3	-	1	-	-	-	-	-	-	1	2	-
CO 5	1	3	-	3	3	3	2	1	1	1	2	2	2	2

UNIT - I

Introduction to IoT: Introduction to Internet of Things, Sensing, Actuation, Basics of Networking, Connectivity Technologies, Sensor Networks Machine-to-Machine Communications Interoperability in IoT, IoT Applications.

UNIT - II

IoT Hardware Components: Introduction to Arduino Programming Integration of Sensors and Actuators with Arduino, Introduction to Raspberry Pi and programming, Implementation of IoT with Raspberry Pi

UNIT - III

IoT data protocols: MQTT, CoAP, AMQP, DDS, HTTP, WebSocket. **Network Protocols for IoT:** 6LowPAN, RPL, IPV6, WiFi, Bluetooth, ZigBee, Z-Wave, LoRaWan, MQTT, XMPP

UNIT – IV

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Cloud and Fog Ecosystem for IoT, Device data storage- Unstructured data storage on cloud/local server, Comparison of Cloud providers, Authentication, Authorization of devices.

UNIT - V

Case Studies: Smart Cities, Smart Homes, Connected Vehicles, Smart Grid, Agriculture, Healthcare, and Activity Monitoring

TEXT BOOKS:

1. A. Bahga and V. Madisetti, "Internet of Things: A Hands-On Approach," Paperback, Universities Press, Reprint 2020.
2. D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, and J. Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things," CISCO.

SUGGESTED READING:

1. P. Raj and A. C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases," CRC Press.
2. R. Kamal, "Internet of Things: Architecture and Design Principles," McGraw Hill Education, Reprint 2018.
3. P. Lea, "Internet of Things for Architects: Architecting IoT Solutions by Implementing Sensors, Communication Infrastructure, Edge Computing, Analytics, and Security," Packt Publications, Reprint 2018.
4. A. Kapoor, "Hands on Artificial Intelligence for IoT," 1st ed., Packt Publishing, 2019.
5. S.-L. Peng, S. Pal, and L. Huang (Editors), "Principles of Internet of Things (IoT) Ecosystem: Insight Paradigm," Springer.

ONLINE RESOURCES:

1. https://owasp.org/www-project-internet-of-things/
2. NPTEL: Sudip Misra, IIT Khargpur, Introduction to IoT: Part-1, https://nptel.ac.in/courses/106/105/106105166/

22ITE11

DEVOPS TOOLS
(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to
1. Provide a comprehensive understanding of DevOps principles and their role in modern software development.
2. Explain the importance of version control systems, with a focus on Git.
3. Explore continuous integration and continuous deployment (CI/CD) using tools like Jenkins and Maven.
4. Introduce containerization concepts through Docker.
5. Explain the automation of software deployment processes using configuration management tools.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Explain the core concepts and benefits of DevOps in software engineering.
2. Analyze the role of version control systems in collaborative development.
3. Describe the CI/CD pipeline and evaluate tools like Jenkins and Maven.
4. Illustrate the use of Docker in containerizing applications.
5. Discuss automated deployment strategies using tools such as Puppet.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	2	1	1	2	1	-	1	2	1	2	1	2	2
CO 2	1	2	1	1	2	1	-	1	2	1	2	1	2	2
CO 3	1	1	1	1	2	1	-	1	2	1	3	1	2	2
CO 4	1	2	1	1	2	1	-	1	2	1	3	1	2	2
CO 5	1	2	1	2	3	1	-	1	2	1	3	1	2	2

UNIT-I

Introduction to DevOps, DevOps Perspective, DevOps and Agile, Team Structure, Coordination, Barriers, the Cloud as a Platform: Features of the Cloud, DevOps Consequences of the Unique Cloud Features, Operations: Operations Services, Scrum, Kanban, and Agile.

UNIT-II

Overview GIT and its principal command lines: Installation, Configuration, Vocabulary, Git Command Lines, Understanding the GIT process and Gitflow pattern: Starting with the Git Process, Isolating your code with branches, Branching Strategy with Gitflow.

UNIT-III

Continuous Integration and Continuous Delivery: Technical Requirements CI/CD principles, Using a package manager in the CI/CD process, Using Jenkins for CI/CD implementation, Using GitLab CI.

UNIT-IV

Containerizing your application with Docker: Installing Docker, Creating Docker file, Building and running a container on a local machine, pushing an Image to Docker Hub, Deploying a container to ACI with CI/CD pipeline. Using Docker for running command Line tools, Introduction to Kubernetes
Tools: Docker Compose, Docker Swarm

UNIT-V

Getting Started with Docker Composer, Deploying a Docker compose containers in ACI, Installing Kubernetes, First example of Kubernetes application of deployment, Deploying the code: The Puppet master and Puppet agents, Ansible, PalletOps, Deploying with SaltStack, DevOps Best Practices, **Tools: Ansible, Saltstack**

TEXT BOOKS:

1. L. Bass, I. Weber, and L. Zhu, "DevOps: A Software Architect's Perspective," 2nd ed., Addison-Wesley, Pearson Publication, 2015.
2. M. Krief, "Learning DevOps: A Comprehensive Guide to Accelerating DevOps Culture Adoption with Terraform, Azure DevOps, Kubernetes, and Jenkins," Packt Publishing, 2022.

SUGGESTED READING:

1. R. Russell and J. Southgate, "Mastering Puppet 5: Optimize Enterprise-Grade Environment Performance with Puppet," Packt Publishing, 2018.
2. J. Verona, "Practical DevOps," Packt Publishing, 2018.

22EEO01

ENERGY MANAGEMENT SYSTEM
(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: None.

COURSE OBJECTIVES: This course aims to
1. Know the concept of Energy Management.
2. Understand the formulation of efficiency for various Engineering Systems
3. Enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding Energy Management

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Know the current Energy Scenario and importance of Energy Conservation.
2. Understand the concepts of Energy Management, Energy Auditing.
3. Interpret the Energy Management methodology, Energy security and Energy Strategy.
4. Identify the importance of Energy Efficiency for Engineers and explore the methods of improving Energy Efficiency in mechanical systems, Electrical Engineering systems
5. Illustrate the Energy Efficient Technologies in Civil and Chemical engineering systems

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	1	-	2	1	-	-	-	1	-	-	-
CO 2	2	1	1	1	-	2	1	-	-	-	1	-	-	-
CO 3	2	2	2	1	-	2	1	-	-	-	1	1	2	1
CO 4	2	2	1	2	2	2	1	-	-	-	1	1	2	1
CO 5	1	1	2	1	1	2	2	-	-	-	1	1	2	1

UNIT-I

Various forms of Energy and its features: Electricity generation methods using different energy sources such as Solar energy, wind energy, Bio-mass energy, and Chemical energy such as fuel cells. Energy Scenario in India, Impact of Energy on economy, development, and environment sectors of national and international perspective.

UNIT-II

Energy Management-I: Defining Energy Management, need for Energy Management, Energy management techniques, importance of Energy Management, managing the Energy consumption, Energy Audit and Types, Energy Audit Instruments.

UNIT-III

Energy Management-II: understanding Energy costs, bench marking, Energy performance, matching energy use to requirement, optimizing the input, fuel & Energy substitution, material and Energy balance diagrams, Energy pricing, Energy and Environment, Energy Security

UNIT-IV

Energy Efficient Technologies-I: Importance of Energy Efficiency for Engineers, Energy Efficient Technology in Mechanical engineering: Compressed Air System, Heating, ventilation and air-

conditioning, Fans and blowers, Pumps and Pumping Systems, **Energy Efficient Technology in Electrical engineering:** Automatic Power Factor Controllers, Energy Efficient Motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, space cooling, energy efficiency of lifts and escalator, energy saving potential of each technology.

UNIT-V

Energy Efficient Technologies-II: Energy Efficient Technology in Civil Engineering: Intelligent Buildings, And Various Energy Efficiency Rating Systems for Buildings, Green Buildings Energy Efficiency: management of green buildings, importance of embodied energy in selection of sustainable materials, green building design, waste reduction/recycling, rainwater harvesting, maintenance of the green buildings, green building certification, Renewable energy applications.

Energy Efficient Technology in Chemical Engineering: Green chemistry, Low carbon cements, recycling paper.

TEXT BOOKS:

1. Umesh Rathore, 'Energy Management', Kataria publications, 2nd ediiton, 2014.
2. G Hariharaiyer, “Green Building Fundamentals”, Notion press.com
3. K V Shama, P Venkataseshaiah, "Energy management and conservation", I. K. International Publishing agency pvt. ltd., 2011, ISBN: 978-93-81141-29-8

SUGGESTED READING:

1. Guide Books for National Certification Examination for Energy Manager / Energy Auditors Book-1: General Aspects.
2. K. Hargroves, K. Gockowiak, K. Wilson, N. Lawry, and C. Desha, "An Overview of Energy Efficiency Opportunities in Mechanical/Civil/Electrical/Chemical Engineering," The University of Adelaide and Queensland University of Technology, 2014.
3. Success Stories of Energy Conservation, Bureau of Energy Efficiency (BEE), New Delhi. Available at: www.bee-india.org

22EGO01

TECHNICAL WRITING SKILLS
(Open Elective-II)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Language proficiency and the ability to simplify complex technical concepts for a diverse audience.

COURSE OBJECTIVES: This course aims to
1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words.
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	2	1	1	-	1	2	3	3	2	3	-	1	2
CO 2	-	1	-	1	-	-	1	2	2	1	2	-	-	3
CO 3	-	2	-	2	-	1	1	2	3	2	2	-	1	3
CO 4	2	2	1	3	-	2	1	3	3	2	2	1	2	3
CO 5	1	1	1	1	-	1	1	3	3	2	2	1	2	3

UNIT-I

Communication – Nature and process. **Channels of Communication** – Downward, upward and horizontal communication. Barriers to communication. **Technical Communication** – Definition, oral and written communication. Importance and need for technical communication. Nature of Technical Communication. Aspects and forms of technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

UNIT-II

Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

UNIT-III

Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters. **Technical Articles:** Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

UNIT-IV

Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.**Technical Proposals:** Definition, types, characteristics, structure and significance.

UNIT-V

Mechanics of Meetings: Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences. **Technical Presentations:** Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

TEXT BOOKS:

1. Meenakshi Raman & Sangeeta Sharma, "Technical Communications-Principles and Practice", Oxford University Press, Second Edition, 2012.
2. M Ashraf Rizvi, "Effective Technical Communication", Tata McGraw Hill Education Pvt Ltd, 2012.

SUGGESTED READING:

1. Kavita Tyagi & Padma Misra, "Basic Technical Communication", PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, "Business Correspondence and Report Writing", Tata McGraw Hill, 2003

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills

22CAO02

ETHICAL INTELLIGENCE
(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Not required

COURSE OBJECTIVES: This course aims to
1. Describe the principles of ethical intelligence.
2. Discuss how ethical intelligence benefits the people we serve and ourselves too.
3. Work to ensure that AI technologies are designed and implemented in a way that benefits everyone

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Gain a deeper understanding of the ethical implications of AI development, deployment, and use.
2. Learn how to make ethical decisions in the age of intelligent machines.
3. Have a code of conduct when working with artificial intelligence at work.
4. Foster a compassionate workplace culture, addressing challenges through empathetic approaches.
5. Acquire the skills to nurture a forgiving culture through real-world case studies and practical insights

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	1	-	1	1	1	1	-	1			
CO 2	-	-	-	-	-	1	1	-	-	-	1			
CO 3	1	1	1	-	-	1	1	-	-	-	1			
CO 4	-	-	-	-	1	1	1	1	1	1	2			
CO 5	1	1	1	1	1	1	1	1	1	1	2			

UNIT-I

Principle of Honesty: Introduction to Ethical Intelligence, Understanding the Principle of Honesty, Importance of Honesty in Personal and Professional Life, Real-world Examples and Case Studies, Exercises and Discussions on Applying Honesty in Decision-Making.

UNIT-II

Principle of Fairness: Exploring the Principle of Fairness, Equity and Equality in Decision-Making, The Role of Fairness in Workplace and Society, Case Studies on Fairness Challenges, Strategies for Promoting Fairness.

UNIT-III

Principle of Responsibility: Understanding the Principle of Responsibility, Accountability in Decision-Making, Balancing Personal and Organizational Responsibility, Ethical Decision-Making Models, Role of Responsibility in Ethical Leadership.

UNIT-IV

Principle of Compassion: Overview of the Principle of Compassion, Empathy and Sympathy in Ethical Decision-Making, Building a Compassionate Workplace Culture, Addressing Challenges with Empathy, Practical Applications of Compassion

UNIT-V

Principle of Forgiveness: Delving into the Principle of Forgiveness, The Power of Forgiveness in Resolving, Ethical Conflicts, Forgiveness in Leadership and Team Dynamics, Case Studies on the Positive Impact of Forgiveness, Cultivating a Forgiving Culture

TEXT BOOKS:

1. B. Weinstein, "Ethical Intelligence: Five Principles for Untangling Your Toughest Problems at Work and Beyond."
2. J. C. Havens, "Heartificial Intelligence: Embracing Our Humanity to Maximize Machines," Illustrated Paperback, February 2, 2016.
3. W. A. Bauer, "Virtuous vs. Utilitarian Artificial Moral Agents," AI and Society, 2020. J. J. Bryson, "Ethics, Moral Philosophy, and AI," 2018.

SUGGESTED READING:

1. M. J. Quinn, "Ethics for the Information Age."
2. M. Coeckelbergh, "AI Ethics."

ONLINE RESOURCES:

1. Ethical Intelligence: Change the Way You Live Your Life | Udemy

22MEO06

PRINCIPLES OF ENTREPRENEURSHIP AND STARTUPS

(Open Elective-II)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Nil

COURSE OBJECTIVES: This course aims to

1. Impart basic concepts and procedure of idea generation.
2. Familiarize the nature of industry and related opportunities and challenges.
3. Familiarize with elements of business plan and its procedure.
4. Learn the project management and its techniques.
5. Know the behavioral issues and time management.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the concept and essence of entrepreneurship.
2. Identify business opportunities and nature of enterprise.
3. Analyze the feasibility of new business plan.
4. Apply project management techniques like PERT and CPM for effective planning and execution of projects.
5. Use behavioral, leadership and time management aspects in entrepreneurial journey.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	-	1	1	1	2	2	1	1	1	1			
CO 2	1	1	1	1	1	2	2	2	2	3	1			
CO 3	1	1	1	2	2	2	2	2	2	3	1			
CO 4	2	1	1	2	2	2	2	1	2	3	1			
CO 5	1	-	1	1	1	-	2	1	1	1	1			

UNIT-I

Entrepreneurship: Definition, Characteristics of an Entrepreneur, Functions of Entrepreneurs, Entrepreneur vs. Intrapreneur, First Generation Entrepreneur, Women Entrepreneurship, Ideas and their Sources, Conception and Evaluation of Ideas. **Behavioral Aspects of Entrepreneurs:** Personality: Determinants, Attributes and Models, Leadership: Concepts and Models, Values and Attitudes, Motivation Aspects.

UNIT-II

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic Growth, Small Scale Industry in India, objectives, Linkage among Small, Medium and Heavy Industries, Types of Enterprises, Corporate Social Responsibility.

UNIT-III

Business Plan: Introduction, Elements of Business Plan and its salient features, Business Model Canvas, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility Studies, Executive Summary.

UNIT - IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, human aspects of project management. **Time Management**: Approaches of Time Management, their strengths and weaknesses. Time Management Matrix, Urgency Addiction.

UNIT - V

Startup: Definition, Startup Ecosystem, Startup Incubator, Need for and Importance of Startups and Incubation Centers. Sources of Finance and Incentives for Startups. Innovation, Creativity, Intellectual Property in Entrepreneurial Journey. Business firm Registration Process in INDIA.

TEXT BOOKS:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw- Hill Publishing Company Ltd, 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi, 2015.

SUGGESTED READING:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5th edition, Tata Mc Graw Hill Publishing Company. Ltd., 2005.
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.

22BTO04

BIOINFORMATICS
(Open Elective-II)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: The school level basic knowledge in Fundamental science is required.

COURSE OBJECTIVES: This course aims to
1. Provide elementary knowledge in biology and bioinformatics and biological information available to a biologist on the web and learn how to use these resources on their own.
2. Learn the fundamentals of biological databases, Sequence analysis, data mining, sequence alignment and phylogenetics.
3. Learn methods for determining the predicting gene and protein.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Explain the basic concepts of biology and bioinformatics.
2. Identify various types of biological databases used for the retrieval and analysis of the information.
3. Explain the sequence analysis and data mining.
4. Discuss the methods used for sequence alignment and construction of the phylogenetic tree.
5. Describe the methods used for gene and protein structure prediction.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	0	-	-	-	-	1	-	1			
CO 2	1	1	-	1	1	-	-	-	1	-	1			
CO 3	2	-	-	1	1	-	-	-	1	-	1			
CO 4	2	-	-	1	1	-	-	-	1	-	1			
CO 5	2	1	-	1	1	-	-	-	1	-	1			

UNIT-I

Introduction and Basic Biology: Bioinformatics- Introduction, Scope and Applications of Bioinformatics; Basics of DNA, RNA, Gene and its structure, Protein and metabolic pathway; Central dogma of molecular biology; Genome sequencing, Human Genome Project.

UNIT-II

Biological Databases: Introduction to Genomic Data and Data Organization, types of databases, biological databases and their classification, Biological Databases - NCBI, SWISS PROT/Uniport, Protein Data Bank, Sequence formats; Information retrieval from biological databases; Data mining of biological databases

UNIT-III

Sequence Analysis and Data Mining: Scoring matrices, Amino acid substitution matrices- PAM and BLOSUM; Gap, Gap penalty; Database similarity searching - BLAST, FASTA algorithms to analyze sequence data, FASTA and BLAST algorithms comparison; Data Mining- Selection and Sampling, Pre-processing and Cleaning, Transformation and Reduction, Data Mining Methods, Evaluation, Visualization, Designing new queries, Pattern Recognition and Discovery, Text Mining Tools

UNIT-IV

Sequence Alignment and Phylogentics: Sequence Alignment – Local and Global alignment; Pairwise sequence alignment – Dynamic Programming method for sequence alignment - Needleman and Wunsch algorithm and Smith Waterman algorithm. Multiple sequence alignment - Methods of multiple sequence alignment, evaluating multiple alignments, applications of multiple sequence alignment. Concept of tree, terminology, Methods of phylogenetic analysis, tree evaluation – bootstrapping, jack knifing

UNIT-V

Macromolecular Structure Prediction: Gene prediction, - neural networks method, pattern discrimination methods, conserved domain analysis; Protein structure basics, protein structure visualization, Secondary Structure predictions; prediction algorithms; Chou-Fasman and GOR method, Neural Network models, nearest neighbor methods, Hidden-Markov model, Tertiary Structure predictions; prediction algorithms; homology modeling, threading and fold recognition, ab initio prediction.

TEXT BOOKS:

1. David Mount, "Bioinformatics Sequence and Genome Analysis", 2nd edition, CBS Publishers and Distributors Pvt. Ltd., 2005
2. Rastogi SC, Mendiratta N and Rastogi P, "Bioinformatics: Methods and Applications Genomics, Proteomics and Drug discovery", 3rdedition, PHI Learning Private Limited, New Delhi, 2010

SUGGESTED READING:

1. Baxebanis AD and Francis Ouellette BF, "Bioinformatics a practical guide the analysis of genes and proteins", 2nd edition, John Wiley and Sons, Inc., Publication, 2001
2. Vittal R Srinivas, "Bioinformatics: A modern approach. PHI Learning Private Limited", New Delhi, 2009
3. JiXiong, "Essential Bioinformatics", Cambridge University Press, 2006

22CSC57

NETWORK SECURITY LAB

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

PREREQUISITE: Data Communication and computer networks.

COURSE OBJECTIVES: This course aims to

1. Provide practical understanding of cryptography and its application to network security.
2. Familiarize with symmetric and asymmetric cryptography.
3. Learn various approaches on encryption techniques and hashing algorithms.
4. Able to understand the significant functionalities of secure communication.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Apply symmetric and asymmetric key algorithms for cryptography and analyze the attacks
2. Identify the use of key distribution scheme
3. Create and evaluate Authentication functions
4. Analyze and design network security protocols
5. Identify and investigate network security threat using tools

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	1	2	-	-	-	1	-	-	2	2	1	-
CO 2	2	1	2	2	1	-	-	1	-	-	1	2	2	-
CO 3	2	1	1	1	1	-	-	1	-	-	1	2	2	-
CO 4	1	1	2	1	1	1	-	1	-	-	1	1	1	-
CO 5	1	1	2	2	2	1	-	1	-	-	2	2	2	-

LIST OF EXPERIMENTS:

1. Perform encryption, decryption using the following Substitution techniques
   (i) Ceaser cipher (ii) Playfair cipher iii) Hill Cipher
2. Perform encryption and decryption using following Transposition techniques
   (i) Rail fence ii) Row Transformation iii) Column Transformation.
3. Implementation of Data Encryption Standard (DES) algorithm for Symmetric key encryption.
4. Implementation of Advanced Encryption Standard (AES) algorithm for Symmetric key encryption.
5. Implementation of RSA Asymmetric key encryption algorithm.
6. Demonstrate how two parties can securely exchange secret keys over an insecure communication channel using the Diffie-Hellman key exchange algorithm.
7. Implementation of SHA-256 cryptographic hash function.
8. Implementation of Digital Signature Standard (DSS) for generating and verifying Digital Signatures.
9. Implementation of Secure Socket Layer (SSL).
10. Demonstrate Intrusion Detection System (IDS) using any tool e.g. Snort or any other tools.

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", 6th Edition, Pearson Education,
2. Chris Brenton, "Mastering Network Security" Bk & Cd-Rom Edition 2017.

SUGGESTED READING:

1. J.W. Rittiaghouse and William M.Hancok "Cyber Security Operations Handbook" Elseviers.
2. Eric Chou, "Mastering Python Networking" 3rd Edition, 2020.
3. Jean-Philippe Aumasson "Serious Cryptography: A Practical Introduction to Modern Encryption", 2017.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs16/preview.

22CSE16N

SOFTWARE TESTING LAB
(Professional Elective-V)

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

PREREQUISITE: Basics of Programming Language and Problem solving, Software Engineering.

COURSE OBJECTIVES: This course aims to
1. Design and implement software test cases using both manual and automated techniques to improve software reliability and fault detection.
2. Demonstrate proficiency in using modern testing tools and frameworks for functional, security, and performance testing.
3. Analyze software testing results to identify, debug, and validate defects across different levels of software development including unit, integration, and system testing.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Apply Black-Box and White-Box testing techniques such as Boundary Value Analysis and Mutation Testing.
2. Utilize automated testing tools like Selenium, TCase, and JMeter for effective software validation.
3. Investigate advanced testing frameworks such as KLEE, AFL, and CBMC to ensure security and correctness.
4. Analyze software behavior through static, dynamic, load, and security testing approaches.
5. Evaluate and choose appropriate testing strategies across unit, integration, system, and acceptance testing phases.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	3	2	-	-	1	1	-	-	1	1	3
CO 2	3	3	3	2	3	1	-	-	1	1	-	1	-	3
CO 3	2	-	2	2	3	-	-	-	-	-	-	1	-	3
CO 4	2	1	1	1	2	-	-	-	-	1	-	1	1	3
CO 5	2	1	1	1	1	-	-	-	-	1	-	1	1	3

LIST OF EXPERIMENTS:
Select one large Information System/Approach per each team and device the following:
1. Program to demonstrate Black box testing using TCase
2. Mutation Testing of Loop Constructs Using Smart-MuVerf
3. Static Verification of Array Bounds and Memory Safety Using CC-SolBMC through Symbolic and SMT-Based Testing
4. Program to demonstrate Web app tool testing using Selenium
5. Program to demonstrate Dynamic Symbolic Executers using KLEE, Tracer-X
6. Program to demonstrate a security testing and fuzzing tool using AFL
7. Program to demonstrate a verifier using CBMC.
8. Program to demonstrate a system testing tool to report load and stress using JMeter.

TEXT BOOKS:
1. Naresh Chauhan, “Software Testing- Principles and practices”, Oxford University Press, Second Edition, 2016

2. Jamie L. Mitchell and Rex Black, “Advanced Software Testing” Vol. 3, Second Edition, 2015

ONLINE RESOURCES:

1. Tcases: The Complete Guide
2. Selenium Tool Suite | GeeksforGeeks
3. Apache JMeter - Apache JMeter™
4. https://github.com/tracer-x/tracer-x
5. https://klee.github.io
6. https://www.cprover.org/cbmc/

22CSE27

APPLIED NATURAL LANGUAGE PROCESSING LAB

(Professional elective-V)

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to

1. Learn the fundamentals of natural language processing.
2. Understand the various text processing techniques in NLP.
3. Understand the role Text Classification, Deep Learning for Text Classification techniques of NLP.
4. Using Topic Modeling, Case Studies and apply the NLP techniques to IR applications.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the fundamental concepts of Natural Language Processing (NLP) and describe the components of the NLP pipeline.
2. Apply and compare various text representation and feature engineering techniques for effective language modeling.
3. Construct and evaluate NLP models using classical and deep learning-based text classification techniques.
4. Analyze and implement different text summarization approaches and examine their applications in real-world scenarios.
5. Design and develop end-to-end NLP pipelines using deep learning to solve practical problems in domains such as healthcare, finance, or retail.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	1	-	-	-	-	-	-	-	-	-	2	1	-
CO 2	1	2	-	-	-	-	-	-	-	-	-	2	1	-
CO 3	-	-	1	2	2	-	-	-	-	-	-	1	1	-
CO 4	-	-	-	2	2	-	-	-	-	-	-	-	1	-
CO 5	-	-	1	-	-	1	-	3	3	2	-	1	1	-

LIST OF EXPERIMENTS:

1. Construct a basic NLP pipeline with data acquisition, text cleaning, and pre-processing steps like tokenization, stemming, and lemmatization.
2. Convert text into vector representations using Bag-of-Words and TF-IDF, and apply machine learning classifiers (e.g., Naive Bayes, SVM) to classify text.
3. Generate and visualize word embeddings using Word2Vec/GloVe and analyze word similarities and analogies, also visualize using t-SNE .
4. Build a sentiment classification model using CNN and LSTM architectures on a dataset like IMDb or Twitter.
5. Extract entities and identify parts of speech from raw text using pre-trained models or CRF models.
6. Design a rule-based or ML-based chatbot with intent recognition, dialog flow, and response generation.
7. Build a simple end-to-end dialog system using seq2seq LSTM models.
8. Apply Topic Modeling with LDA and NMF to uncover hidden topics from a document corpus using LDA and NMF, and visualize them.

9. Perform extractive summarization using TextRank and abstractive summarization using T5 or BART.
10. Build a QA system using BERT or RoBERTa on datasets like SQuAD.

TEXT BOOKS:

1. S. Vajjala, B. Majumder, A. Gupta, and H. Surana, "Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems," 1st ed., O'Reilly Media, June 2020.
2. J. Allen, "Natural Language Understanding," 2nd ed., Benjamin/Cummings, 1995.

SUGGESTED READING:

1. T. Siddiqui and U. S. Tiwary, "Natural Language Processing and Information Retrieval," Oxford University Press, 2008.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106101007/
2. http://www.cs.colorado.edu/~martin/sp2.html
3. https://web.standford.edu/~jurafsky/sp3/

22CSE29

FULL STACK DEVELOPMENT LAB
(Professional Elective-V)

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

PREREQUISITE: Web Programming

COURSE OBJECTIVES: This course aims to
1. Explore various features of JS and its functionality.
2. Understand the basics of mongodb and its Data Model.
3. Understand core features of JavaScript and React JS.
4. Learn Express JS and Node JS frameworks to develop responsive web applications.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Create web pages with a good aesthetic sense of design using ES6.
2. Understand and build logical relationships between documents using MongoDB.
3. Use MongoDB concepts in Web Application Development using React JS.
4. Develop single page applications in React Framework.
5. Build an end-to-end application from scratch using React JS, NODE JS, Express JS and Mongo DB.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	3	1	1	-	-	1	1	1	-	1	1	2
CO 2	1	1	1	1	2	-	-	-	-	1	1	1	1	2
CO 3	-	-	2	1	2	-	-	-	-	-	1	1	1	3
CO 4	-	-	2	1	2	-	-	-	-	-	2	-	1	3
CO 5	-	-	2	2	1	-	-	-	-	-	2	1	1	2

LIST OF EXPERIMENTS:
(Note: Setup a Node JS server in Visual Studio to run the following experiments applications)
1. Explore and practice the new features introduced in ES6.
2. Build a class-based system (e.g., Person, Student) demonstrating inheritance, static methods, and arrow functions within methods.
3. Perform basic CRUD operations on a MongoDB collection using the shell.
4. Designing the schema, applying the cursor methods to fetch the data and exporting the data for the given requirements of a collection.
5. Develop React applications to demonstrate the use of class component, functional component, props and routing in React JS.
6. Develop an application to demonstrate the lifecycle of React JS.
7. Write code to understand different hooks in React JS.
8. Create a Node script that performs file operations like reading, writing, appending text.
9. Create a REST API in Express with all CRUD operations (GET, POST, PUT, DELETE).
10. Case Study: Develop an application for Event Scheduling System
11. The Event Scheduling System allows users to create, view, edit, and delete events with details like date, time, description, and location. Users can manage their schedule efficiently. Extra features include a calendar view for easy visualization and the ability to filter upcoming or past events for better organization.

TEXT BOOKS:

1. Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", second Edition, Apress Publications, 2019.
2. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and React JS Web Development", 2nd edition, Perason Education, 2018.

SUGGESTED READING:

1. Alex Banks, Eve Porcello, "Learning React Modern Patterns for Developing React Apps", 2nd Edition, Oreilly Media Inc, 2020.
2. David Hows, Peter Membrey, EelcoPlugge – "MongoDB Basics", Apress, 2014.

ONLINE RESOURCES:

1. https://web.stanford.edu/class/cs142/index.html
2. https://nodejs.org/en/docs/
3. https://www.mongodb.com/
4. https://reactjs.or

22CSE31

INTERNET OF THINGS LAB
(Professional Elective-V)

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

PREREQUISITE: Computer Architecture and Micro Processor, Programming for Problem Solving.

COURSE OBJECTIVES: This course aims to
1. Understand the basics of IoT and its components.
2. Impart practical knowledge on IoT applications.
3. Develop skills required for building real-time IoT based projects

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Use of various hardware and software IoT components.
2. Perform experiments by Interfacing I/O devices, sensors to Raspberry Pi/Arduino.
3. Understand and analyze communication protocols in IoT.
4. Monitor data and controlling of devices.
5. Develop Real time IoT based projects

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	-	1	-	-	-	-	-	-	1	3	-
CO 2	1	-	-	-	1	-	-	-	-	-	-	1	2	-
CO 3	1	2	-	-	1	-	-	-	-	-	-	1	2	-
CO 4	1	-	-	-	1	-	-	-	-	-	-	1	2	-
CO 5	1	3	3	3	3	3	2	1	1	1	2	2	2	2

LIST OF EXPERIMENTS:
1. Introduction to IoT equipment and perform necessary software installation.
2. Write a program to interface LED/Buzzer with Arduino and to turn ON LED for 1sec after every 2 seconds.
3. Write a program to interface Digital sensor PIR with Arduino and to turn ON LED when motion detected.
4. Write a program to interface DHT22 sensor with Arduino and display temperature and humidity readings.
5. Write a program to interface servo motor with Raspberry Pi.
6. Write a program to interface soil moisture sensor with Raspberry Pi and print moisture readings.
7. Write a program to send and receive messages using MQTT protocol.
8. Write a program to interface flame/smoke sensor with Arduino /Raspberry Pi and give an alert message when flame/smoke is detected.
9. Write a program to upload sensor data to local/cloud server using wifi.
10. Implement Smart Home Automation System using Arduino/Raspberry Pi.

TEXT BOOKS:
1. A. Bahga and V. Madisetti, "Internet of Things: A Hands-On Approach," Paperback, Universities Press, Reprint 2020.
2. D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, and J. Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things," CISCO.

SUGGESTED READING:

1. P. Raj and A. C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases," CRC Press.
2. R. Kamal, "Internet of Things: Architecture and Design Principles," McGraw Hill Education, Reprint 2018.
3. P. Lea, "Internet of Things for Architects: Architecting IoT Solutions by Implementing Sensors, Communication Infrastructure, Edge Computing, Analytics, and Security," Packt Publications, Reprint 2018.
4. A. Kapoor, "Hands on Artificial Intelligence for IoT," 1st ed., Packt Publishing, 2019.
5. S.-L. Peng, S. Pal, and L. Huang (Editors), "Principles of Internet of Things (IoT) Ecosystem: Insight Paradigm," Springer.

ONLINE RESOURCES:

1. https://owasp.org/www-project-internet-of-things/
2. NPTEL: Sudip Misra, IIT Khargpur, Introduction to IoT: Part-1,https://nptel.ac.in/courses/106/105/106105166/

22ITE12

DEVOPS TOOLS LAB
(Professional Elective-V)

Instruction	3 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aims to
1. Understand the fundamentals of DevOps in the context of software development.
2. Learn version control using Git for efficient code management.
3. Build, test, and deploy applications using Jenkins and Maven.
4. Utilize Docker for containerization of applications.
5. Develop and manage an end-to-end software deployment

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Apply DevOps principles to streamline software development and delivery.
2. Use version control tools such as Git for collaborative coding and tracking changes.
3. Implement continuous integration and delivery using Jenkins and Maven.
4. Demonstrate containerization techniques using Docker.
5. Describe and execute deployment processes using automation tools like Puppet.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	1	1	3	3	3	1	-	1	2	1	2	1	2	2
CO 2	1	1	3	3	3	1	-	1	2	1	2	1	2	2
CO 3	1	1	3	3	3	1	-	1	2	1	3	1	2	2
CO 4	1	1	3	3	3	1	-	1	2	1	3	1	2	2
CO 5	1	1	3	3	3	1	-	1	2	1	3	1	2	2

LIST OF EXPERIMENTS:
1. To understand DevOps: Principles, Practices, and DevOps Engineer Role and Responsibilities.
2. Explore the Version Control System tools for Source Code Management.,
3. Install git and create a GitHub account and To execute various GIT operations.
4. Installing and configuring Jenkins to set up a build job will help you comprehend continuous integration.
5. To understand Jenkins Master-Slave Architecture and scale your Jenkins standalone implementation by implementing slave nodes.
6. To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers.
7. To learn Docker file instructions, build an image for a sample web application using Docker file.
8. Deploy a containerized application on Kubernetes cluster.
9. To install and Configure Pull based Software Configuration Management and provisioning tools using Puppet.
10. To learn Software Configuration Management and provisioning using Puppet Blocks(Manifest, Modules, Classes, Function)

TEXT BOOKS:
1. L. Bass, I. Weber, and L. Zhu, "DevOps: A Software Architect’s Perspective," 2nd ed., Addison-Wesley, Pearson Publication, 2015.

2. M. Krief, "Learning DevOps: A Comprehensive Guide to Accelerating DevOps Culture Adoption with Terraform, Azure DevOps, Kubernetes, and Jenkins," Packt Publishing, 2022.

SUGGESTED READING:

1. R. Russell and J. Southgate, "Mastering Puppet 5: Optimize Enterprise-Grade Environment Performance with Puppet," Packt Publishing, 2018.
2. J. Verona, "Practical DevOps," Packt Publishing, 2018.

22CSC38N

TECHNICAL SEMINAR

Instruction	2 P Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	1

OBJECTIVES:

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the topic
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Submit a single page synopsis before the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound as per the format given by the Department.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Study and review research papers of new field/areas and summarize them.
2. Identify promising new directions of various cutting edge technologies in Computer Science and Engineering.
3. Impart skills to prepare detailed report describing the selected topic/area.
4. Acquire skills to write technical papers/articles for publication.
5. Effectively communicate by making an oral presentation before the evaluating committee.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	2	3	-	-	-	1	-	-	1	1	-
CO 2	2	3	2	2	2	-	-	1	1	2	-	2	2	2
CO 3	2	3	2	3	2	-	-	2	2	2	1	-	-	-
CO 4	3	2	2	2	2	-	-	-	2	2	2	-	-	-
CO 5	3	2	2	2	-	-	-	-	-	2	-	-	-	-

- Seminars are to be scheduled **from 3rd week to the last week of the semester** and any change in schedule shall be discouraged. For the award of sessional marks students are **judged by three (3) faculty members** and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.
- **Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.**

Guidelines for awarding Marks		
S. No.	**Description**	**Max. Marks**
1	Contents and Relevance	10
2	Presentation Skills	10
3	Preparation of slides & Presentation	05
4	Question and Answers	05
5	Report in prescribed format	20

22CSC37N

PROJECT PART – 1

Instruction	4 P Hours per week
Duration of SEE	-
SEE	-
CIE	50 Marks
Credits	2

OBJECTIVES:

The objective of '*Project Phase – I'* is to enable the students to take up an investigative study in the broad areas of Computer Science and Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on **an individual basis or two students in a group**, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and Study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/ Modelling / Simulation / Experiment / Design /Feasibility.
4. Preparing a Review paper on chooses topic.
5. Preparing a Written Report on the Study conducted.
6. Final Seminar, as oral Presentation before the Department Review Committee.

COURSE OUTCOMES:

After the completion of this course, the student will be able to

1. Review the literature related to the problem area / selected topic.
2. Complete the tasks of problem statement, proposed solution and prepare a synopsis.
3. Gather the required data and Set up the environment for the implementation.
4. Conduct preliminary analysis/modelling/simulation experiment.
5. Communicate the work effectively in both oral and written forms.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	2	-	-	-	-	1	-	-	2	2	3
CO 2	2	3	2	3	3	3	-	3	2	3	2	3	2	-
CO 3	2	1	2	3	3	2	-	-	2	1	3	1	1	-
CO 4	2	3	2	3	3	-	-	-	2	-	3	1	-	-
CO 5	2	1	1	3	-	-	-	-	3	3	2	-	-	-

Guidelines for awarding CIE (Max. Marks: 50)		
Evaluation by	Max. Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report/Synopsis Submission
Department Review Committee (DRC)	5	Relevance of the Topic
	10	Slide Preparation & Presentation
	5	Question and Answers
	5	Submission of Report

Review-1 shall be scheduled from **3rd week onwards to approve the problem statement**. **Review-2** shall be scheduled after the first mid exam. For the award of marks, students are judged by the DRC consisting of three (3) faculty members based on the relevance of the problem statement, oral & written presentation, and report along with the supervisor's marks.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION
(Inline with AICTE Model Curriculum with effect from AY 2027-28)
(R22A Regulation)

SEMESTER –VIII

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE	Maximum Marks		
			L	T	P/D	in Hours	CIE	SEE	
THEORY									
5.	22CEM01	Environmental Science	2	-	-	2	-	50	Non Credit
6.	22xxxxx	Open Elective Course-III	3	-	-	3	40	60	3
PRACTICAL									
7.	22EGC03	Employability Skills	-	-	2	3	50	50	1
8.	22CSC39N	Project Part-II	-	-	8	-	100	100	4
TOTAL			**5**	**-**	**10**	**-**	**190**	**260**	**8**
Clock Hours Per Week: 15									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

Open Elective -III	
22CEO01	Infrastructure for Smart Cities
22ADO01	Industry 5.0:Applcations of AI
22CHO02	Fundamentals of Nano Science and Nano Technology
22EEO06	Waste Management
22EGO02	Gender Sensitization

22CEM01

ENVIRONMENTAL SCIENCE

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	-
Credits	Non-Credit

COURSE OBJECTIVES: This course aims to

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance.
3. Identify the importance of interlinking of food chain.
4. Learn about various attributes of pollution management and waste management practices.
5. Make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Identify various natural resources and effects of their over utilization.
2. Outline the working mechanism of ecosystem.
3. Illustrate the importance of bio-diversity conservation.
4. Identify remediation measures for environmental pollution through legislations.
5. Explain environmental issues and possible sustainable solutions.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	1	-	-	-	2	2	-	-	-	1	-	-	-
CO 2	3	1	-	-	-	1	1	-	-	-	1	-	-	-
CO 3	3	1	-	-	-	2	2	-	-	-	1	-	-	-
CO 4	3	1	-	-	-	2	2	2	-	-	1	-	-	-
CO 5	3	1	-	-	-	2	3	-	-		1	-	-	-

UNIT-I

Environmental Studies: Definition, Scope and importance, need for public awareness. **Natural resources:** Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT–II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT–III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT–IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards. **Environmental**

Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involvedin enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT–V

Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

TEXT BOOKS:

1. Y. Anjaneyulu, "Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria & Sons, 2009.

SUGGESTED READING:

1. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. https://archive.nptel.ac.in/courses/120/108/120108004/

22CEO01

INFRASTRUCTURE FOR SMART CITIES
(Open Elective-III)

Instruction	3 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to
1. Comprehend the Necessity of Infrastructural Development for Smart Cities.
2. Illustrate the Components and Planning Aspects of a Smart City.
3. Outline Smart Transportation Systems for Smart Cities.
4. Summarize the Significance of Disaster Resilient Infrastructure in Smart Cities.
5. Review Policies and Implementation of Smart Cities at National and Global Perspectives

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand the necessity of infrastructural development for smart cities.
2. Illustrate the components and planning aspects of a smart city.
3. Outline smart transportation systems for smart cities.
4. Summarise the significance of disaster resilient infrastructure in smart cities.
5. Review policies and implementation of smart cities at national and global perspective.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	-	-	1	-	-	-	-	-	2	-	3
CO 2	2	-	-	-	-	1	-	-	-	-	-	2	-	3
CO 3	2	-	-	-	3	1	-	-	-	-	-	2	-	3
CO 4	2	3	-	-	3	1	-	-	-	-	-	2	-	3
CO 5	2	-	-	-	-	1	-	-	-	-	3	2	-	3

UNIT-I

Fundamental of smart city & Infrastructure: Introduction of Smart City, Concept of smart city, Objective for smart cities. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment

UNIT-II

Planning and development of Smart city Infrastructure: Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security.

UNIT-III

Intelligent transport systems: Connected vehicles, autonomous vehicles, GPS, Navigation system, traffic safety management, mobility services, E-ticketing.

UNIT-IV

Disaster resilient Infrastructure: Electricity, sanitation and water supply systems, fire hazard management, earthquake resilient structures, ICT tools.

UNIT-V

Infrastructure Management: System and Policy for Smart city, integrated infrastructure management systems, worldwide policies for smart city, Government of India - policy for smart city, Smart cities in India, Case studies of smart cities

TEXT BOOKS:

1. J. S. Pipkin, M. E. La Gory, and J. R. Balu (Eds.), "Remaking the City: Social Science Perspective on Urban Design," State University of New York Press, Albany. ISBN: 0-87395-678-8.
2. R. Giffinger, C. Fertner, H. Kramar, R. Kalasek, N. Pichler-Milanovic, and E. Meijers, "Smart Cities – Ranking of European Medium-Sized Cities," Smart Cities, Centre of Regional Science, Vienna, 2007.

SUGGESTED READING:

1. R. Giffinger, C. Fertner, H. Kramar, R. Kalasek, N. Pichler-Milanovic, and E. Meijers, "Smart Cities – Ranking of European Medium-Sized Cities," Smart Cities, Centre of Regional Science, Vienna, 2007.
2. Government of India - Ministry of Urban Development, "Mission Statement & Guidelines on Smart City Scheme," [Online]. Available: http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines (1).pdf
3. G. N. S., "Infrastructure Engineering and Management," Wiley-Interscience, 1988.
4. W. R. Hudson, R. Haas, and W. Uddin, "Infrastructure Management," McGraw-Hill, 1997.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_ar12/preview
2. http://acl.digimat.in/nptel/courses/video/105105160/L01.html

22ADO01

INDUSTRY 5.0: APPLICATIONS OF AI
(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to
1. Introduce Artificial Intelligence in detail from its basics to future applications and tools of Industry 5.0
2. Provide insights on technological advancements and focus on preparing students and researchers for Industry 5.0
3. Impart the importance of AI technologies in assistive technology
4. Discuss the available applications of AI for promoting early diagnosis of diseases
5. Understand the various AI technologies

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Summarize the evolution, current applications, and future challenges of artificial intelligence.
2. Evaluate the foundational elements and impacts of AI within machine learning paradigms.
3. Analyze AI's effectiveness in diagnosing diseases and enhancing assistive technology.
4. Design AI-driven solutions for modernizing and improving agricultural practices.
5. Assess AI's role in advancing radiotherapy techniques and ensuring quality assurance.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	1	2	1	2	1	2	3			
CO 2	3	3	3	3	1	2	1	2	1	2	3			
CO 3	3	3	3	3	1	2	1	2	1	2	3			
CO 4	3	3	3	3	1	2	1	2	1	2	3			
CO 5	3	3	3	3	1	2	1	2	1	2	3			

UNIT-I

Artificial Intelligence Insight: Artificial Intelligence: What and Why, History of AI, What is AI?,The Basics, AI Environment, Challenges in AI, Current work in AI for environment, Customer Experience (CX) and the use of AI, Future of AI, Future challenges in AI

UNIT-II

Influence of AI in Machine Learning: Definition, What is Machine Learning, Importance of Machine Learning, Types of Machine Learning, Approaches of Machine Learning - Machine Learning Algorithm, Programming Languages, Frameworks, Databases, Deployment tools, Methodology for Model Building, Machine learning methods, Statistical Measures, Application areas of Machine Learning, Medical Machine Learning , Influence of AI and ML in Clinical and Genomic Diagnostics.

UNIT-III

Artificial Intelligence in Healthcare sector & Assistive Technology (AT): AI in diagnosis of Genetic Diseases, Cancer, Diabetes, AI in Diagnosis of Syndrome, AI in diagnosis of Psychiatric Disorders, Depression, Alzheimer's Disease, Autism Spectrum Disorder, Anxiety, Parkinson's Disease, AI in other Diagnosis, Infectious, Lung and Brain Disease, Case studies on AI in systems Biology, AI technologies in Systems Biology towards Pharmacogenomics, AI in Systems Biology for Cancer Cure, Applications of AI for COVID-19 Pandemic, Transformative impact of AI on AT, AI experience and

AT for disables people in India, AI Powered technology for an inclusive world .

UNIT-IV

Artificial Intelligence in Agriculture: Need of AI in Agriculture, Emerging Agricultural Technologies, Soil and water sensors, Weather Tracking, Satellite Imaging Agriculture, Automation Systems, RFID Technology, Potential Agricultural Domain for Modernization, AI transformation in Agricultural Scenarios.

UNIT-V

Artificial Intelligence in Radiotherapy: Importance of Artificial Intelligence in Radiotherapy , AI tools for automated treatment planning (ATP), Present ATP techniques, AI applications, Advancements and Research Guidance in ATP, AI challenges in ATP, AI in Intensity-modulated Radiotherapy (IMRT), AI for IMRT Dose Estimation, AI for IMRT Planning Support, AI for Modeling IMRT outcome and plan deliverability, AI for AUTO- Segmentation of OAR in IMRT, AI in Brachytherapy, AI in Radiotherapy Quality Assurance, Challenges associate with AI for Quality Assurance in RT, Future directions to improve AI-based Quality Assurance in RT, AI in Radiation Biology, AI in Radiation Protection/Safety, Motivations to develop AI-Based systems for Radiation protection .

TEXT BOOKS:

1. Kaliraj, P., & Devi, T. (Eds.). (2021). Artificial Intelligence Theory, Models, and Applications (1st ed.). CRC Press, Taylor & Francis Group, Boca Raton. Auerbach Publications. eBook ISBN: 9781032008097. https://doi.org/10.1201/978100317586

22CHO02

FUNDAMENTALS OF NANO SCIENCE AND NANO TECHNOLOGY

(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. The introduction and classification of nanoscience and nanomaterials
2. Explain the unique properties of nanomaterials.
3. The various synthesis routes of nanomaterials
4. The tools required for the characterization of nanomaterials.
5. The applications of nanomaterials.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Explain the types of nanomaterials and classify them.
2. Understand various defects, and the effect of nano dimensions on the material behavior.
3. Discuss the bottom up and top-down synthesis of nanomaterials.
4. Explain the characterization of nanomaterials using various techniques.
5. Enlist and explain various applications of nanomaterials in diversified fields and areas

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	-	-	1	-	-	-	-	2			
CO 2	2	1	1	-	-	1	-	-	-	-	2			
CO 3	2	1	1	-	-	1	-	-	-	-	2			
CO 4	2	1	1	-	-	1	-	-	-	-	2			
CO 5	2	1	1	-	-	1	-	-	-	-	2			

UNIT-I

Introduction: History and scope, classification of nanostructured materials, Fascinating nanostructures, applications of nanomaterials

UNIT-II

Unique properties of nanomaterials: Microstructure and defects in nanocrystalline materials – dislocations, Twins, stacking faults and voids, Grain boundaries, triple junctions and disclinations.
Effect of nano-dimensions on materials behavior – Elastic properties, magnetic properties, electrical properties, optical properties, thermal properties, and mechanical properties.

UNIT-III

Synthesis Routes: Bottom-up approaches – PVD, CVD, sol-gel process, wet chemical synthesis and self-assembly. Top-down approaches – mechanical alloying, nanolithography.

UNIT-IV

Tools to Characterize Nanomaterials: Scanning electron microscopy, transmission electron microscopy, x-ray diffraction, atomic force microscopy, nanoindentation

UNIT-V

Applications of Nanomaterials : Nano-electronics, Micro- and Nano-electromechanical systems (MEMS/NEMS), Nano sensors, Nano catalyst, Food and Agriculture Industry, Cosmetics and

Consumer Goods, Structure and Engineering, Automotive Industry, Water Treatment and the Environment, Nano-medical Applications, Textiles, Paints, Energy, Defense and Space Applications.

TEXT BOOKS:

1. Murty, B. S., Shankar, P., Baldev Raj, Rath, B. B., & Murday, J. (2013). Textbook of Nanoscience and Nanotechnology. Bangalore: Springer.
2. Poole, C. P., Jr., & Owens, F. J. (2012). Introduction to Nanotechnology (Wiley India Edition).

SUGGESTED READING:

1. Pradeep, T. Nano: The Essentials. McGraw-Hill Education.
2. Ashby, M. F., Ferreira, P. J., & Schodek, D. L. Nanomaterials, Nanotechnologies and Design.
3. Ferry, D. (2000). Transport in Nano Structures. Cambridge University Press.
4. Challa, S., Kumar, S. R., & Carola, J. H. (Eds.). Nanofabrication Towards Biomedical Application: Techniques, Tools, Application, and Impact.
5. O'Connell, M. J. Carbon Nanotubes: Properties and Applications.
6. Dutta, S. Electron Transport in Mesoscopic Systems. Cambridge University Press.

ONLINE RESOURCES:

1. Nanotechnology, Science and Applications by Prof. Prathap Haridoss, IIT Madras https://onlinecourses.nptel.ac.in/noc22_mm33/preview
2. Introduction to Nanoscience and Nanotechnology, Prof. Dr. Swapna Nair, Central University of Kerala
3. https://onlinecourses.swayam2.ac.in/cec24_cy03/preview

22EEO06

WASTE MANAGEMENT
(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: None.

COURSE OBJECTIVES: This course aims to
1. Provide the concept of effective utilization of any scrap
2. Dispense the processes of all disciplines of engineering.
3. Impart the technique of connectivity from waste to utility.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Categorize the waste based on the physical and chemical properties.
2. Explain the hazardous waste management and treatment process.
3. Illustrate the environmental risk assessment, methods, mitigation and control.
4. Interpret the biological treatment of solid and hazardous waste.
5. Identify the waste disposal options; describe the design and construction, operation, monitoring, closure of landfills.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	2	-	-	2	-	-	-	-	1	-	-	-
CO 2	2	1	2	-	-	2	-	-	-	-	1	-	-	-
CO 3	2	1	3	-	-	2	-	-	-	-	1	1	1	1
CO 4	2	3	3	-	-	2	-	-	-	-	1	1	1	1
CO 5	2	3	3	-	-	2	-	-	-	-	1	1	1	1

UNIT -I

Introduction to Waste Management and Municipal Solid Waste Management: Classification of waste, Agro based, Forest residue, Industrial waste, e-Waste, Municipal Solid Waste Management, Fundamentals Sources, Composition, Generation rates, Collection of waste, Separation, Transfer and Transport of waste, Treatment and disposal options.

UNIT -II

Hazardous Waste Management and Treatment: Hazardous waste identification and classification, Hazardous waste management: Generation, Storage and collection, Transfer and transport, Processing, Disposal, Hazardous waste treatment: Physical and chemical treatment, Thermal treatment, Biological treatment, Pollution prevention and waste minimization, Hazardous wastes management in India.

UNIT -III

Environmental Risk Assessment: Defining risk and environmental risk, Parameters for toxicity quantification, Types of exposure, Bio-magnifications, Effects of exposure to toxic chemicals, Risk analysis and Risk matrix, Methods of risk assessment, Mitigation and control of the risk, Case studies.

UNIT -IV

Biological Treatment: Solid and hazardous waste composting, Bioreactors, Anaerobic decomposition of solid waste, Principles of biodegradation of toxic waste, Inhibition, Co-Metabolism, Oxidative and reductive processes, Slurry phase bioreactor, In-situ-remediation.

UNIT -V:

Waste Disposal: Key issues in waste disposal, Disposal options and selection criteria, Sanitary landfill principle, Landfill processes, Landfill gas emission: Composition and properties, Hazards, Migration, Control, Leach ate Formation: Composition and properties. Leach ate migration, Control, Treatment, Environmental effects of landfill, Landfill operation issues, Design and construction, Operation, Monitoring, Closure of landfills-Landfill remediation, National and International waste management programs.

TEXT BOOKS:

1. Pichtel, J. (2005). Waste Management Practices. CRC Press, Taylor and Francis Group.
2. LaGrega, M. D., Buckingham, P. L., & Evans, J. C. (1994). Hazardous Waste Management. McGraw Hill International Editions, New York.
3. Watts, R. J. (1997). Hazardous Wastes - Sources, Pathways, Receptors. John Wiley and Sons, New York.

SUGGESTED READING:

1. Shah, K. L. (1999). Basics of Solid and Hazardous Waste Management Technology. Prentice Hall.
2. Bhatia, S. C. (2007). Solid and Hazardous Waste Management. Atlantic Publishers & Distributors.

22EGO02

GENDER SENSITIZATION
(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: No specific is required.

COURSE OBJECTIVES: This course aims to
1. Sensibility regarding issues of gender in contemporary India.
2. A critical perspective on the socialization of men and women.
3. Popular debates on the politics and economics of work while helping them reflect critically on gender violence.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand the difference between "Sex" and "Gender" and be able to explain socially constructed theories of identity.
2. Recognize shifting definitions of "Man" and "Women" in relation to evolving notions of "Masculinity" and "Femininity".
3. Appreciate women's contributions to society historically, culturally and politically.
4. Analyze the contemporary system of privilege and oppressions, with special attention to the ways in which gender intersects with race, class, sexuality, ethnicity, ability, religion, and nationality.
5. Demonstrate an understanding of personal life, the workplace, the community and active civic engagement through classroom learning.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	-	1	-	-	2	1	1	-	-	1	-	1	2
CO 2	-	-	1	-	-	2	1	1	-	-	1	-	1	2
CO 3	-	-	1	-	-	2	2	2	1	1	1	-	1	2
CO 4	-	-	1	-	-	3	2	2	1	1	1	-	2	2
CO 5	-	-	1	-	-	2	2	3	1	1	1	1	2	2

UNIT-I

Understanding Gender: Gender: Why Should We Study It? (Towards a World of Equals: Unit -1) **Socialization:** Making Women, Making Men (Towards a World of Equals: Unit -2) Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities.

UNIT-II

Gender and Biology: Missing Women: Sex Selection and Its Consequences (Towards a World of Equals: Unit -4) Declining Sex Ratio. Demographic Consequences. **Gender Spectrum:** Beyond the Binary (Towards a World of Equals: Unit -10) Two or Many? Struggles with Discrimination.

UNIT-III

Gender and Labour: Housework: the Invisible Labour (Towards a World of Equals: Unit -3) "My Mother doesn't Work." "Share the Load". **Women's Work:** Its Politics and Economics (Towards a World of Equals: Unit -7) Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

UNIT-IV

Issues of Violence: Sexual Harassment: Say No! (Towards a World of Equals: Unit -6) Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "Chupulu". **Domestic Violence:** Speaking Out (Towards a World of Equals: Unit -8) Is Home a Safe Place? -When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice. Thinking about Sexual Violence (Towards a World of Equals: Unit -11) Blaming the Victim-"I Fought for my Life…." - Additional Reading: The Caste Face of Violence.

UNIT-V

Gender: Co – Existence-Just Relationships: Being Together as Equals (Towards a World of Equals: Unit -12) Mary Kom and Onler. Love and Acid just do not Mix. Love Letters. Mothers and Fathers. Additional Reading: Rosa Parks-The Brave Heart.

TEXT BOOKS:

1. Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu "Towards a World of Equals: A Bilingual Textbook on Gender", Telugu Akademi, Hyderabad, 2015.

SUGGESTED READING:

1. Menon, Nivedita. "Seeing like a Feminist", Zubaan-Penguin Books, New Delhi, 2012.
2. Abdulali Sohaila, "I Fought For My Life…and Won", Available online at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

ONLINE RESOURCES:

1. https://aifs.gov.au/publications/gender-equality-and-violence-against-women/introduction
2. https://theconversation.com/achieving-gender-equality-in-india

Note: Since it is an Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field from engineering departments.

22EGC03

EMPLOYABILITY SKILLS

Instruction	2 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

PREREQUISITE: Basic Knowledge of Soft skills in the professional setting.

COURSE OBJECTIVES: This course aims to

1. Learn the art of communication, participate in group discussions and case studies with confidence and to make effective presentations.
2. With- resume packaging, preparing them to face interviews.
3. Build an impressive personality through effective time management, leadership qualities, self-confidence and assertiveness.
4. Understand professional etiquette and to make them learn academic ethics and value system.
5. Be competent in verbal aptitude.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals, learn to manage time effectively and deal with stress.
4. Make the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
5. Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	-	1	-	-	-	1	2	3	3	1	3	-	-	-
CO 2	-	-	-	-	-	-	1	-	2	-	1	-	-	-
CO 3	-	-	-	-	-	1	1	2	1	1	3	-	-	-
CO 4	-	1	1	-	-	1	2	3	3	1	3	-	1	-
CO 5	-	-	-	-	-	-	2	3	2	1	3	-	-	-

UNIT-I

Verbal Aptitude: Error Detection, Articles, Prepositions, Tenses, Concord and Transformation of Sentences-Jumbled Words/Sentences- Vocabulary, Synonyms, Antonyms, One Word Substitutes, Idioms and Phrases, Word/Sentence/Text Completion- Reading Comprehension.

UNIT-II

Group Discussion & Presentation Skills: Dynamics of Group Discussion-Case Studies- Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Accuracy, Coherence. Elements of Effective Presentation – Structure of a Presentation – Presentation tools – Body language - Preparing an Effective PPT.

UNIT-III

Behavioural Skills: Personal strength analysis-Effective Time Management- Goal Setting- Stress management. **Corporate Culture –** Grooming and etiquette-Statement of Purpose (SOP).

UNIT-IV

Mini Project: Research-Hypothesis-Developing a Questionnaire-Data Collection-Analysis-General and Technical Report - Writing an Abstract –Technical Report Writing-Plagiarism-Project Seminar.

UNIT-V

Interview Skills: Cover Letter and Résumé writing – Structure and Presentation, Planning, Defining the Career Objective, Projecting ones Strengths and Skill-sets – Interviews: Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Mock Interviews.

TEXT BOOKS:

1. Leena Sen, "Communication Skills", Prentice-Hall of India, 2005.
2. Gulati and Sarvesh, "Corporate Soft Skills", New Delhi: Rupa and Co., 2006.
3. Edgar Thorpe and Showick Thorpe , "Objective English", 2nd edition, Pearson Education, 2007.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010.

SUGGESTED READING:

1. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004.
2. R.S. Aggarwal, "A Modern Approach to Verbal & Non-Verbal Reasoning", 2018.
3. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989.
4. Shalini Verma, "Body Language - Your Success Mantra", S Chand, 2006.

22CSC39N

PROJECT PART - II

Instruction	8 Hours per week
Duration of SEE	-
SEE	100 Marks
CIE	100 Marks
Credits	4

OBJECTIVES:

The objective of '*Project Part-2*' is to enable the students for further investigative study taken up, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Department Review Committee.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Demonstrate a sound technical knowledge of their selected topic.
2. Design engineering solutions to complex problems utilizing a systematic approach.
3. Conduct investigations by using research-based knowledge and methods to provide valid conclusions.
4. Create/select/use modern tools for the modelling, prediction and understanding the limitation of complex engineering solutions.
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	3	2	1	-	-	-	-	2	-	-	2	2	-
CO 2	2	3	2	3	-	-	-	-	-	-	-	2	-	-
CO 3	2	3	2	3	-	-	-	-	1	-	-	2	3	-
CO 4	2	2	-	3	3	-	-	-	1	-	-	-	3	-
CO 5	2	1	1	1	-	-	-	-	-	3	-	-	-	3

Review-1 shall be scheduled from **3rd week onwards** to monitor the progress of the project work. **Review-2** shall be scheduled after the **first mid exam**. For the award of CIE marks, students are judged by the DRC consisting of three (3) faculty members based on the *work progress, relevance, quality, oral & written presentation, demonstration* and *report* along with the *supervisor's marks*. The complete evaluation guidelines follows:

Guidelines for awarding CIE (Max. Marks: 100)		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Department Review Committee (DRC)	15	Review 1
	15	Review 2
	10	Demonstration of Work / Results
	10	Innovation / Research Related Work
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to Publication
	10	Report Preparation
	10	Analytical/ Programming/Experimentation Skills

Guidelines for awarding SEE (Max. Marks: 100)		
Evaluation by	**Max. Marks**	**Evaluation Criteria/Parameter**
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the Project • Innovation, • Applications, • Live Research Projects, • Scope for further study, • Applications to Society
	20	Viva-Vice

OPEN ELECTIVES

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)
DEPARTMENT of COMPUTER SCIENCE AND ENGINEERING
SCHEME OF INSTRUCTIONS AND EXAMINATION
(Inline with AICTE Model Curriculum with effect from AY 2024-25)
(R22A Regulation)

OPEN ELECTIVES

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1.	22CSO01N	Introduction to Web Technologies	3	-	-	3	40	60	3
2.	22CSO02	Introduction to Database Management Systems	3	-	-	3	40	60	3
3.	22CSO03	Software Testing Methodology	3	-	-	3	40	60	3
4.	22CSO04N	Web Programming With JavaScript	3	-	-	3	40	60	3
5.	22CSO05N	Fundamentals of Java Programming	3	-	-	3	40	60	3
6.	22CSO06	Introduction to Software Engineering	3	-	-	3	40	60	3

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**
T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE-Semester End Examination**

22CSO01N

INTRODUCTION TO WEB TECHNOLOGIES

(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Knowledge on a programming language.

COURSE OBJECTIVES: This course aims to

1. Acquire knowledge on HTML, Java Script and XML to develop client side web applications.
2. Learn developing web applications using Django.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the technologies required for developing web application.
2. Identify and choose HTML tags, CSS and java scripts to develop well-structured and easily maintained web pages.
3. Design and Develop interactive and innovative web pages using various platforms/technologies like HTML, CSS, XML, JAVASCRIPT.
4. Create and deploy web applications in web server by using Django concepts.
5. Evaluate different web applications to implement optimal solutions for real time problems.

CO-PO Articulation Matrix

PO/PSO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	2	-	-	-	-	-	-	1			
CO 2	1	2	2	2	2	2	-	-	-	1	2			
CO 3	2	1	2	2	1	1	3	-	-	-	-			
CO 4	2	1	-	3	2	1	3	1	1	1	2			
CO 5	2	2	1	2	3	2	3	-	1	1	2			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Web Basics: WWW Browsers, Web Servers, URL, MIME, HTTPS. **Introduction HTML5:** basic tags, Images, Tables, Lists, Forms, Layout, Graphics, span and div tags. Grid, Cascading Style Sheets.

UNIT-II

XML: Introduction, uses of XML, the Syntax of XML, XML Document Structure, DTD, Namespaces, XML schemas, displaying Raw XML Documents, displaying XML documents with CSS.

UNIT-III

The Basics of Java script: Primitive operations and Expressions, Arrays, Functions, Pattern Matching Using Regular Expressions, Document Object Model, Element Access in JavaScript, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements. **Dynamic Documents with Java Script:** Positioning Elements, Moving Elements, Dynamic Content..

UNIT-IV

Django: Introduction, Models, Templates, supported data bases, URL configuration. Templates, Modifying and Improving the Templates, Creating a Form.

UNIT-V

Applications: Introduction to Ajax, Node.js and JSON. **Bootstrap:** Introduction to Bootstrap, bootstrap grid, bootstrap components. **Web Application Frameworks: AngularJS, JQuery.**

TEXT BOOKS:

1. HTML5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery), Dreamtech, 2017.
2. Miguel Grinberg, "Flask Web Development", 1st Edition-2014.

SUGGESTED READING:

1. Chris Bates, "Web Programming, building internet applications", 2nd Edition, John Wiley & Sons, 2010.
2. Alok Ranjan, Abhilasha Sinha, Ranjit Battwad, "JavaScript for Modern Web Development: Building a Web Application Using HTML, CSS, and JavaScript", BPB, 2020.

ONLINE RESOURCES:

1. https://www.w3.org/standards/webdesign/
2. https://www.w3schools.com/angular/
3. https://www.w3schools.com/jquery/default.asp
4. https://www.tutorialspoint.com/flask/index.htm
5. https://www.tutorialspoint.com/web2py/index.htm
6. https://www.tutorialspoint.com/fuelphp/index.htm

22CSO02

INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS

(Open Elective)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aims to

1. Learn data models, conceptualize and depict a database system using E-R diagrams.
2. Understand the internal storage structures in a physical DB design.
3. Learn the fundamental concepts of transaction processing techniques.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the fundamental concepts of database and design using ER model.
2. Apply SQL to find solutions to basic queries.
3. Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
4. Understand the concepts like data storage, indexing and transaction processing.
5. Analyze concurrency control and recovery mechanisms.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	3	1	1	-	-	-	-	-	-	-			
CO 2	3	2	1	2	-	-	-	-	-	-	-			
CO 3	3	2	1	1	-	-	-	-	-	-	-			
CO 4	3	3	1	2	-	-	-	-	-	-	-			
CO 5	3	2	1	2	2	-	-	-	-	-	-			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures. **Database Design and E-R Model:** Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT-II

Relational Model: Structure of Relational Databases, Database Schema, Keys. **Structured Query Language:** Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression.

UNIT-III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT-IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files. **Transaction Management:**

Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability.

UNIT-V

Concurrency Control: Introduction, Lock-Based Protocols, Timestamp-Based Protocols. **Deadlocks Handling:** Deadlock Detection and Prevention. **Recovery System:** Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery.

TEXT BOOKS:

1. Silberschatz, Korth and Sudarshan, "Database System Concepts", 7th Edition, McGraw-Hill, 2021.
2. C.J. Date, "An Introduction to Database Systems", 8th edition, Pearson, 2020,

SUGGESTED READING:

1. Raghu Ramakrishnan, JohnnesGehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2014.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Pearson Education, 4th Edition, 2006.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106104135

22CSO03

SOFTWARE TESTING METHODOLOGY
(Open Elective)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Software engineering

COURSE OBJECTIVES: This course aims to
1. Understand the importance of software testing in the software development lifecycle.
2. Learn various software testing methodologies and techniques.
3. Gain hands-on experience with industry-standard testing tools.
4. Develop the skills to design and execute comprehensive test plans.
5. Analyze and interpret test results to improve software quality.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. List a range of different software testing techniques and strategies and be able to apply specific (automated) unit testing methods to the projects.
2. Distinguish characteristics of structural testing methods.
3. Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible.
4. Discuss the functional and system testing methods.
5. Demonstrate various issues for object-oriented testing.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	-	-	-	-	1	-			
CO 2	3	2	2	2	-	-	-	2	-	-	-			
CO 3	2	2	3	2	-	-	-	2	-	-	-			
CO 4	3	3	2	-	-	-	-	-	-	-	-			
CO 5	2	2	3	2	2	2	-	-	-		1			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT - I

Introduction: Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs. **Flow graphs and Path testing:** Basic concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT - II

Transaction Flow Testing: Transaction flows, transaction flow testing techniques. Dataflow testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing. **Domain Testing:** domains and paths, Nice & ugly domains, domain testing, domain and interface testing, domains and testability.

UNIT - III

Paths, Path products and Regular expressions: Path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection. **Logic-Based Testing:** overview, decision tables, path expressions, kv charts, specifications.

UNIT - IV

State, State Graphs and Transition testing: State graphs, good & bad state graphs, state testing, Testability tips.

UNIT - V

Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools. (Student should be given an exposure to a tool like JMeter or Win-runner).

TEXT BOOKS:

1. Boris, Beizer, "Software Testing Techniques", 2nd Edition, Dreamtech, 2003.
2. Dr. K. V. K. K. Prasad, "Software Testing Tools", 2nd Edition, Dreamtech, 2005.

SUGGESTED READING:

1. Brian Marick, "The craft of Software Testing", 3rd Edition, Pearson Education, 2009.
2. Software Testing Techniques – SPD(Oreille)
3. Edward Kit, "Software Testing in the Real World", 2nd Edition, Pearson, 1995.
4. Perry, "Effective Methods of Software Testing", 2nd Edition, John Wiley, 2006.
5. Meyers, "Art of Software Testing", 4th Edition, John Wiley, 2004.

ONLINE RESOURCES:

1. https://www.coursera.org/courses?query=software%20testing
2. https://nptel.ac.in/courses/106101163

22CSO04N

WEB PROGRAMMING WITH JAVASCRIPT

(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Problem Solving and Programming, Object Oriented Programming.

COURSE OBJECTIVES: This course aims to

1. Write and debug JavaScript.
2. Interact with the Document Object Model (DOM) using JavaScript.
3. Experience the role of JavaScript in HTML5.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Understand the technologies required for developing web application like HTML and JavaScript.
2. Identify and choose HTML tags, CSS and java scripts to develop well-structured and easily maintained web pages.
3. Develop web pages using Object Oriented concepts.
4. Choose appropriate DOM methods and properties to access HTML elements.
5. Design and Develop interactive and innovative web pages using various platforms/technologies like HTML, CSS, and JAVASCRIPT.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	2	-	-	-	-	-	-	1			
CO 2	1	2	2	2	2	2	-	-	-	-	2			
CO 3	2	1	2	2	1	1	3	-	-	-	-			
CO 4	1	1	-	2	2	1	3	-	-	-	-			
CO 5	2	1	2	2	2	1	3	-	-	-	2			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Web Basics: WWW Browsers, Web Servers, URL, MIME, HTTPS (SSL). **Introduction HTML5:** basic tags, Images, Tables, Lists, Forms, Layout, Graphics, span and div tags. Grid, Cascading Style Sheets.

UNIT-II

The Basics of Java script: Variables, Primitive data types, Converting Datatypes, Operators, Expressions, Arrays properties and methods, Multi-dimensional Arrays, Logic Statements, Loops, Functions, Variable Scope in Functions.

UNIT-III

Object oriented programming: Classes, Objects, Constructors, Methods, Properties. **Intermediate JavaScript:** Pattern Matching Using Regular Expressions, Functions and the argument objects, JavaScript hoisting, using strict mode, JSON

UNIT-IV

Document Object Model (DOM): Basic DOM traversing, Element Access in the DOM, Events and Event Handling, Handling Events from Body, Button, Text Box and Password Elements. **Dynamic Documents with Java Script:** Positioning Elements, Moving Elements, Dynamic Content.

UNIT-V

Built-In JavaScript Methods: Parsing Numbers, Array Methods, String Methods, Number Methods, Math Methods, Date Methods.

TEXT BOOKS:

1. HTML5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery), Dreamtech, 2017.
2. Laurence Lars Svekis, Maaike van Putten and Rob Percival, "JavaScript from Beginner to Professional: Learn JavaScript quickly by building fun, interactive, and dynamic web apps, games, and pages", Packt publishing Ltd.

SUGGESTED READING:

1. Chris Bates, "Web Programming, building internet applications", 2nd Edition, John Wiley & Sons, 2010.
2. Alok Ranjan, Abhilasha Sinha, Ranjit Battwad, "JavaScript for Modern Web Development: Building a Web Application Using HTML, CSS, and JavaScript", BPB, 2020.

ONLINE RESOURCES:

1. https://www.w3schools.com/js/
2. https://www.tutorialspoint.com/javascript/index.htm
3. https://www.javatpoint.com/javascript-tutorial
4. https://www.geeksforgeeks.org/javascript/
5. https://www.programiz.com/javascript
6. https://javascript.info/

22CSO05N

FUNDAMENTALS OF JAVA PROGRAMMING

(Open Elective)

Instruction	3 L Hours per week
Duration of End Examination	3 Hours
Semester End Examination	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Any Programming Language, Object Oriented Language.

COURSE OBJECTIVES: This course aims to

1. Provide an introduction to object oriented Programming Concepts.
2. Introduce the different features of Java Programming.
3. Provide some theoretical concepts on predefined classes in java.

COURSE OUTCOMES: After the completion of this course, the student will be able to

1. Apply Object Oriented Programming Concepts like classes, inheritance, polymorphism.
2. Understand the reusability of code using packages and classes.
3. Apply the features of java programming like interfaces, exceptions and threads.
4. Develop applications using collection frameworks.
5. Use the predefined packages like java.util and java.lang.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	2	2	2	-	-	-	-	-	-	-	-			
CO 2	2	2	2	-	-	-	-	-	-	-	-			
CO 3	2	2	2	-	-	-	-	-	-	-	-			
CO 4	2	2	2	-	-	-	-	-	-	-	-			
CO 5	2	2	2	-	-	-	-	-	-	-	-			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Java Programming- History of Java, Java buzzwords, OOP Concepts, Data types, Variables, Constants, Scope and Life time of variables, Operators, Type conversion and casting, Control Flow Statements, arrays, simple java programs. **Classes and Methods:** concepts of classes, objects, methods, constructors, access control, static keyword, garbage collection, recursion.

UNIT-II

Inheritance – Inheritance Basics, using Super, Types of Inheritance, this and final keyword, **Polymorphism** – Overloading methods and overloading constructors, Method Overriding, Dynamic Method dispatching, abstract classes and methods. Using Final with Inheritance, The Object Class, Object Casting.

UNIT-III

Packages- Defining, creating and accessing a package, importing packages. **Interfaces**-Interfaces Vs Abstract classes, defining an interface, implement interfaces, extending interface.

UNIT-IV

Exception handling – Exception Handling Fundamentals, Exception Types, try, Catch, throw, Throws , Finally built-in exceptions, Create your own exception class. **Multi-threading**- thread life cycle, creating threads, synchronizing threads.

UNIT-V

Files- Streams, Byte streams, Character streams, Text input/output. **Java.util package**: Collection classes-ArrayList, List, TreeSet, Iterator, HashMap ,StringTokenizer class, **Java.lang**- String Class

TEXT BOOKS:

1. Java-The Complete Reference, 10th edition, Herbert schildt, TMH.
2. Introduction to java Programming, Comprehensive Version, Global Edition, Y Daniel Liang

SUGGESTED READING:

1. Programming with Java 7th edition, E Balagurusamy
2. Understanding OOP with Java, updated edition, T. Budd, Pearson education.
3. Core Java an integrated approach, dreamtech publication, Dr. R.NageswaraRao.
4. Object Oriented Programming through Java, P. Radha Krishna, Universities Press

22CSO06

INTRODUCTION TO SOFTWARE ENGINEERING
(Open Elective)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

PREREQUISITE: Basic Programming Knowledge

COURSE OBJECTIVES: This course aims to
1. Introduce the fundamental concepts and importance of software engineering and development life cycles.
2. Equip students with skills for requirements analysis, software design, and project management.
3. Provide knowledge on software development, testing techniques, and quality assurance practices.

COURSE OUTCOMES: After the completion of this course, the student will be able to
1. Understand and explain key software engineering concepts and process models.
2. Identify and analyze user requirements for software systems.
3. Apply software project management techniques including estimation and risk management.
4. Design software using modeling tools like DFDs and UML diagrams.
5. Implement software development practices and testing techniques to ensure quality software.

CO-PO Articulation Matrix

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	3	3	3	3	3	3	3	3			
CO 2	3	3	3	3	3	3	3	3	3	3	3			
CO 3	2	3	3	3	3	2	-	3	3	3	3			
CO 4	3	3	3	3	3	3	-	3	3	3	3			
CO 5	2	3	1	2	2	1	-	3	3	2	-			

1 - Slightly, 2 - Moderately, 3 – Substantially

UNIT-I

Introduction to Software Engineering: Definition and importance of Software Engineering, Characteristics of software ,Software crisis, Software engineering challenges and ethics, Software Development Life Cycle (SDLC),Software process models – Waterfall, Incremental, Spiral, An Agile Development: Agility, Agile Process, and Agile Process Models- Extreme Programming (XP),Scrum

UNIT-II

Requirement Engineering, Types of requirements – Functional and Non-functional, Eliciting Requirements, Negotiating Requirements, and Validating Requirements. Software Requirements Analysis and Specification: Value of a Good SRS, Problem Analysis, Requirements Specification,

UNIT-III

Software Project Management: Effort Estimation, Project Schedule and Staffing, Quality Planning, Risk Management, Estimation for Software Projects: Decomposition Techniques - Software Sizing, Problem-Based Estimation, An Example of LOC-Based Estimation, An Example of FP-Based Estimation, COCOMO Model

UNIT-IV

Software Design and Architecture: Principles of software design – Modularity, Abstraction, Cohesion, Coupling, Function-oriented modelling, Flow-oriented modelling-DFDs with Examples, UML modelling – Use Case Diagram, Class Diagram, Sequence Diagram, Activity Diagram, Software architecture and architectural styles – Layered, Client-Server.

UNIT-V

Software Development and Testing: Coding Principles and guidelines, Incremental Development of Code, Code Inspection – Planning, Software testing – Unit, Integration, System, Acceptance testing, Testing techniques – Black-box and White-box, Test case design – Boundary value and Equivalence partitioning, Quality Concepts - What is Quality, Software Quality, Objectives, Software Quality Attributes (McCall's, HP)

TEXT BOOKS:

1. Sommerville "Software Engineering", 10th Edition, Pearson, 2016.
2. Roger S. Pressman, Software Engineering: A Practitioner's Approach, 8th Edition, McGraw Hill, 2014.

SUGGESTED READING:

1. Pankaj Jalote, "Software Engineering Precise Approach", Wiley Publishers, 2012
2. Rajib Mall, Fundamentals of Software Engineering, 5th Edition, PHI, 2018.

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106101061/
2. Udemy:https://www.udemy.com/share/101BHy3@YYJn8BxwvS6cGfnCsiIlxyA-lUjwZmA2xN5WmMbd8hlGxwhc4N0DF7KaEOaz4eDnMg==/